



Edward M. Augustus, Jr.
City Manager

CITY OF WORCESTER

cm2021sep16093710

Attachment for Item # 10.10 A

September 22, 2021

TO THE WORCESTER CITY COUNCIL

COUNCILORS:

Mr. Mayor and City Councilors, in January 2020 I, along with the leadership of the Worcester Fire Department, requested an independent and thorough review of the Department. A contract was signed in March 2020 with Emergency Services Consulting International (ESCI) to conduct and complete that review.

While the COVID-19 pandemic significantly delayed that effort, I respectfully submit for the review of this Honorable Body, the final report of ESCI, which includes a Standard of Cover, Community Risk Assessment and Master Plan.

This review was commissioned with the purposeful intent of ensuring that the residents of Worcester continue to be served by the best, most well-equipped and trained Fire Department possible – one about which they feel an immense sense of pride – and to create the safest possible environment for our firefighters to deliver on that mission.

This report offers no sugarcoating: ESCI has determined that the culture of the Worcester Fire Department must change. To their credit, during the review process the leadership and members of the Department laid bare their needs, their thoughts and their hopes for a safer, more robust Department. The report makes clear that firefighters are seeking strong leadership, greater accountability and more training.

ESCI has recognized the difficulties and unique challenges to firefighting in Worcester due to topography, housing stock, density and weather. Among their recommendations is a significant increase in staffing to help ensure on-scene tasks can be accomplished quickly, safely and with the appropriate supervision.



OFFICE OF THE CITY MANAGER, CITY HALL, WORCESTER, MA 01608
TELEPHONE (508) 799-1175 | FAX (508) 799-1208
EMAIL: citymanager@worcesterma.gov

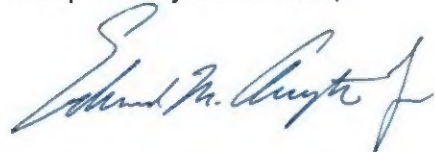


In requesting this review, we wanted a plan built upon national standards. Now we have that plan and we can move forward. Some of the recommendations can and will be implemented with expediency; others will take more time, effort and resources. With the help of ESCI, the Department will start the process of developing a strategic plan to prioritize the recommendations in this Master Plan and set the direction of the Department for the next three to five years. As we conduct that process, all the recommendations in this report will be considered.

My Administration will work closely with leadership among the Fire Department and Local 1009 to address areas of growth and implement significant and sustainable improvements within the Department.

We have a tremendous Fire Department that has faced unimaginable challenges, saved countless lives, and responds each and every day to crises big and small across our City. The men and women of the Worcester Fire Department are dedicated and passionate about their jobs. They love this City and the people they serve. We owe it to them to make sure they have all the support and tools they need to do the job we ask and expect them to do. That is the goal of this report, and that is our ultimate commitment to them.

Respectfully submitted,

A handwritten signature in blue ink, reading "Edward M. Augustus, Jr.", with a stylized flourish at the end.

Edward M. Augustus, Jr.
City Manager



Worcester Fire Department

Massachusetts

Master Plan

Community Risk Assessment: Standards of Cover

2021

ESCI Emergency Services
Consulting International

Providing Expertise & Guidance that Enhances Community Safety

Table of Contents

Table of Contents.....	i
Executive Summary.....	1
Master Plan.....	1
Community Risk Assessment: Standard of Cover.....	1
Strategic Plan.....	1
Project Timeline	2
Summary of Findings.....	3
The Worcester Fire Department Culture	3
Opportunities to Change the Worcester Fire Department Culture.....	4
<i>Opportunity 1: Fire Department Leadership Team</i>	<i>5</i>
<i>Opportunity 2: Communication Network.....</i>	<i>5</i>
<i>Opportunity 3: Chain of Command</i>	<i>5</i>
<i>Opportunity 4: Rules & Regulations and Guidelines</i>	<i>5</i>
<i>Opportunity 5: Training</i>	<i>6</i>
<i>Opportunity 6: Promotional Process including Professional Development</i>	<i>6</i>
<i>Opportunity 7: Recruitment, Application, and Hiring Process</i>	<i>7</i>
<i>Opportunity 8: Operational Staffing</i>	<i>7</i>
<i>Opportunity 9: Support Services Staffing</i>	<i>7</i>
<i>Opportunity 10: Emergency Response Deployment</i>	<i>7</i>
The Strategic Plan	8
The Need for Collaboration	9
Acknowledgments	10
Emergency Services Consulting International Team.....	11
Introduction.....	12
Project Methodology	12
<i>Evaluation of Current Conditions</i>	<i>13</i>
<i>Review of Draft Report.....</i>	<i>13</i>
<i>Stakeholder Input</i>	<i>15</i>
<i>Staffing.....</i>	<i>16</i>
<i>Accountability.....</i>	<i>16</i>
Organization Overview.....	20
Service Area Population & Demographics	20
History, Formation, & General Description of Worcester Fire Department	21
Current Service Delivery Infrastructure	21
Governance & Lines of Authority	21

Organizational Design	24
Community Risk Assessment.....	25
Population and Population Density	26
Demographics	28
<i>Education</i>	<i>29</i>
<i>Income and Unemployment</i>	<i>30</i>
<i>Race and Ethnicity</i>	<i>31</i>
<i>Health Insurance.....</i>	<i>32</i>
<i>Home Ownership</i>	<i>32</i>
<i>At-Risk Populations</i>	<i>34</i>
Physical Hazards	37
<i>Dam Failure</i>	<i>38</i>
<i>Drought.....</i>	<i>38</i>
<i>Earthquakes</i>	<i>38</i>
<i>Extreme Temperatures.....</i>	<i>39</i>
<i>Flooding</i>	<i>40</i>
<i>Hurricanes</i>	<i>42</i>
<i>Severe Snowstorms/Ice Storms/Nor'easter.....</i>	<i>45</i>
<i>Severe Thunderstorms</i>	<i>45</i>
<i>Tornadoes</i>	<i>45</i>
<i>Wildfires</i>	<i>47</i>
<i>Winds.....</i>	<i>48</i>
Technological (Human-Caused) Hazards	48
<i>Transportation.....</i>	<i>48</i>
<i>Land Use</i>	<i>50</i>
<i>Physical Assets Protected.....</i>	<i>57</i>
The Worcester Hazard Mitigation Plan.....	68
Risk Prioritization	71
<i>Establishing Community Risk Priorities</i>	<i>72</i>
<i>Risk Assessment by First Due District</i>	<i>73</i>
<i>Identifying and Categorizing Community Risk</i>	<i>74</i>
Financial Analysis	86
Fund Accounting	86
Historical Revenue and Expense	89
<i>Revenue</i>	<i>89</i>
Expense	90
<i>Net Impact on City General Fund.....</i>	<i>97</i>
Status Quo Projection.....	99

<i>Expense Assumptions</i>	99
Status Quo Forecast	102
Financial Basis for Cost Projections	103
<i>Fiscal Year 2021 Personnel Costs</i>	104
<i>Fiscal Year 2021 Capital Apparatus/Equipment Costs</i>	105
<i>Fiscal Year 2021 Facility Capital/Operating Costs</i>	106
<i>Fiscal Year 21 Decision Unit Staffing Costs</i>	108
Management Components	113
Mission	113
Vision	113
Values	114
Internal Communications Processes	115
<i>Non-Emergency Communications</i>	115
<i>Emergency Communications</i>	116
External Communications Processes	117
Hiring Process	117
Promotional Process	117
Health and Wellness Programs	117
<i>Employee Assistance</i>	117
<i>Safety Committee</i>	118
Planning for Fire and Rescue Service Delivery	118
<i>The Current Planning Process</i>	118
<i>Tactical Planning Within the Organization</i>	119
<i>Operational Planning Within the Organization</i>	120
<i>Long-Range Master Planning Efforts</i>	125
<i>Strategic Planning</i>	125
Capital Assets and Capital Improvement Programs	127
Facilities	127
<i>Automatic Sprinkler Protection</i>	129
<i>Back-In Bays</i>	129
<i>Cancer Prevention Engineering</i>	130
<i>Fire Headquarters/Training Division/Maintenance Shop/Station 3</i>	130
<i>Facility Security</i>	130
<i>Fire Station Renovation and Construction</i>	131
Apparatus	131
<i>Apparatus Replacement</i>	133
<i>Support Equipment</i>	135
<i>Support Equipment Replacement</i>	135

<i>Fleet Maintenance</i>	<i>136</i>
Staffing	137
Administration & Support Staffing	137
<i>Training.....</i>	<i>138</i>
<i>Fire Prevention.....</i>	<i>144</i>
<i>Safety Division.....</i>	<i>153</i>
<i>Maintenance</i>	<i>154</i>
Operations Staffing	154
<i>Staff Allocation of Various Functions</i>	<i>154</i>
<i>Special Operations.....</i>	<i>156</i>
Service Delivery and Performance	158
Service Demand Review	158
<i>Service Demand by Incident Type</i>	<i>159</i>
<i>Temporal Variation</i>	<i>162</i>
<i>Population Density and Geographical Demand</i>	<i>164</i>
Resource Distribution Analysis	167
<i>NFPA 1710 Criteria.....</i>	<i>167</i>
<i>ISO Criteria.....</i>	<i>168</i>
Resource Concentration Study	173
Response Reliability Review	175
<i>Call Concurrency.....</i>	<i>175</i>
<i>Unit Hour Utilization</i>	<i>176</i>
Response Performance Summary	178
<i>Call Processing Time Performance</i>	<i>180</i>
<i>Turnout Time Performance.....</i>	<i>181</i>
<i>Travel Time Performance</i>	<i>182</i>
<i>Response Time Performance</i>	<i>184</i>
<i>Total Response Time Performance.....</i>	<i>185</i>
Mutual & Automatic Aid Systems	186
Future System Demand Projections.....	187
Major Development Projects	187
Population Growth Projections	187
Service Demand Projections.....	188
Establishment of Performance Objectives	190
<i>Dynamics of Fire in Buildings</i>	<i>190</i>
<i>Emergency Medical Event Sequence</i>	<i>193</i>
<i>Response Time Performance Objectives</i>	<i>195</i>

Opportunities and Recommendations	196
Opportunity 1: Fire Department Leadership Team.....	196
<i>Recommendation 1.1: When the current Fire Chief retires, the Chief position should remain vacant until such time that there is a qualified candidate for Fire Chief within the Worcester Fire Department.....</i>	<i>196</i>
<i>Recommendation 1.2: Increase Administrative Staffing.....</i>	<i>196</i>
Opportunity 2: Communication Network	197
<i>Recommendation 2.1: Design and implement a Department-wide Communication Plan.....</i>	<i>197</i>
<i>Recommendation 2.2: Release the Board of Inquiry Reports.</i>	<i>198</i>
<i>Recommendation 2.3: Adopt Mission, Vision, and Values Statements.</i>	<i>198</i>
<i>Recommendation 2.4: Provide more community outreach to engage the residents and business owners within the City of Worcester.....</i>	<i>198</i>
Opportunity 3: Chain of Command	198
<i>Recommendation 3.1: Review and update as necessary the Chain of Command. Department leaders should then be held accountable for consistently following the Chain of Command.</i>	<i>199</i>
<i>Recommendation 3.2: Review and update as necessary the current fire department administration's "Open Door Policy."</i>	<i>199</i>
Opportunity 4: Rules & Regulations and Guidelines	199
<i>Recommendation 4.1: Make it a priority to update the Rules and Regulations as well as the Guidelines.</i>	<i>199</i>
<i>Recommendation 4.2: Develop a current Code of Conduct Standard.</i>	<i>200</i>
Opportunity 5: Training.....	200
<i>Recommendation 5.1: The Worcester Fire Department must take steps to stabilize the Training Division.</i>	<i>201</i>
<i>Recommendation 5.2: Ensure that incumbent firefighter training is provided throughout the year—even when there is a Recruit School in progress.</i>	<i>201</i>
<i>Recommendation 5.3: Reconfigure the Training Division to better manage the training and mentoring of new firefighters.....</i>	<i>201</i>
<i>Recommendation 5.4: Training drills and refreshers should be predetermined and developed by the Training Division.</i>	<i>201</i>
<i>Recommendation 5.5: Each shift should be assigned an on-duty Training Officer to serve as the liaison between operations and the Training Division.....</i>	<i>202</i>
<i>Recommendation 5.6: A policy should be developed clearly articulating that each employee is responsible for completing all training requirements assigned to them and that all supervisors are directly responsible for ensuring that training assignments are satisfactorily completed by all employees reporting to them.</i>	<i>202</i>
<i>Recommendation 5.7: Develop an Annual Training Program that is communicated to all members at the start of every year.</i>	<i>202</i>
<i>Recommendation 5.8: Integrate outside instructors into the Worcester Fire Department Training Program.</i>	<i>203</i>
<i>Recommendation 5.9: An online learning platform such as Target Solutions would allow for more efficiency and better tracking for training purposes.</i>	<i>203</i>
<i>Recommendation 5.10: Establish a formal feedback/input mechanism to receive necessary end-user feedback about the training program.</i>	<i>203</i>

<i>Recommendation 5.11: Regularly assess the workload of the Training Division to determine whether additional staffing is necessary to ensure that effective training is delivered on a continual basis.</i>	<i>203</i>
<i>Recommendation 5.12: Encourage all uniformed members to avail themselves of the opportunity to attend the National Fire Academy on a paid stipend once each year.</i>	<i>204</i>
Opportunity 6: Promotional Process including Professional Development	204
<i>Recommendation 6.1: Establish minimum criterion to determine time in grade, education, certification, competency, and professional development requirements for each position prior to allowing any individual to promote or work out of class in a temporary assignment.....</i>	<i>204</i>
<i>Recommendation 6.2: Develop a Professional Development Program for all positions within the organization.</i>	<i>204</i>
<i>Recommendation 6.3: Train and certify all personnel who hold the position of Lieutenant to the level of Fire Officer I.</i>	<i>205</i>
<i>Recommendation 6.4: Train and certify all personnel who hold the position of Captain to the level of Fire Officer II.</i>	<i>205</i>
<i>Recommendation 6.5: Require completion of the National Fire Academy's Managing Officer Program for all personnel holding the position of District Chief within the department.</i>	<i>205</i>
<i>Recommendation 6.6: Require completion of the National Fire Academy's Executive Officer Program for those holding the position of Deputy Chief and Chief within the department.</i>	<i>206</i>
Opportunity 7: Recruitment, Application, and Hiring Process	206
<i>Recommendation 7.1: Customize the Civil Service process to better assess an applicant's candidacy for the specific position of Worcester Firefighter instead of using the current generic process.....</i>	<i>206</i>
<i>Recommendation 7.2: The functions associated with the new firefighter hiring process should be reassigned from the Training Division to the City of Worcester Human Resources Department.</i>	<i>207</i>
<i>Recommendation 7.3: The Worcester Fire Department should consider modifying its hiring processes to allow for lateral transfers of Massachusetts Certified Firefighters.....</i>	<i>207</i>
Opportunity 8: Operational Staffing	207
<i>Recommendation 8.1: All engines and ladder trucks should be staffed with a minimum of four personnel....</i>	<i>207</i>
<i>Recommendation 8.2: All engine and ladder companies should consist of at least one officer and with no more than one out-of-class assignment per company.....</i>	<i>208</i>
<i>Recommendation 8.3: Take steps to determine the cause of and reduce the practice of "shipping out" to different fire stations.</i>	<i>208</i>
<i>Recommendation 8.4: The Worcester Fire Department should make the position of Driver a promoted position.</i>	<i>208</i>
<i>Recommendation 8.5: Review and update the current Time-Off Policy.....</i>	<i>208</i>
<i>Recommendation 8.6: Review the mental health and substance abuse programs to ensure that firefighters have the resources they need when they need them.</i>	<i>209</i>
<i>Recommendation 8.7: Establish a comprehensive occupational medical program that includes medical evaluations for candidates and members.</i>	<i>209</i>
<i>Recommendation 8.8: Make it a priority to alert only the fire station(s) dispatched to calls to reduce the volume of radio traffic that is currently transmitted to all of the stations.....</i>	<i>209</i>
<i>Recommendation 8.9: Assign a second full-time employee to Special Operations.</i>	<i>210</i>

<i>Recommendation 8.10: Establish performance objectives in accordance with NFPA 1710 Section 4.1.2.2, then routinely analyze performance data.....</i>	<i>210</i>
<i>Recommendation 8.11: The Worcester Fire Department should provide an annual report to the AHJ in accordance with NFPA 1710 4.1.2.5.1.</i>	<i>212</i>
Opportunity 9: Support Services Staffing	213
<i>Recommendation 9.1: Develop an incentive program that makes it more desirable for members to come off shift work and accept a position with Monday–Friday hours.</i>	<i>213</i>
<i>Recommendation 9.2: Increase the number of Life Safety Educators on staff.</i>	<i>213</i>
<i>Recommendation 9.3: Increase the number of Fire Inspectors to bring inspection frequency into compliance with NFPA 1730.</i>	<i>214</i>
<i>Recommendation 9.4: Increase the number of Fire Investigators to comply with NFPA 1730.</i>	<i>214</i>
<i>Recommendation 9.5: Regularly review city demographic information for “at risk” populations and realign targeted Community Risk Reduction Programs as population changes occur.</i>	<i>215</i>
<i>Recommendation 9.6: Develop a program to provide call coverage by members of the Fire Prevention Division outside of normal business hours.</i>	<i>216</i>
<i>Recommendation 9.7: Conduct an evaluation of the Worcester Fire Department’s information technology needs.</i>	<i>216</i>
<i>Recommendation 9.8: Ensure that fire investigators do not operate alone on fire scenes.</i>	<i>216</i>
Opportunity 10: Emergency Response Deployment	216
<i>Recommendation 10.1: Modify the initial response sent to structure fires to satisfy critical staffing needs based on risk and hazard.</i>	<i>217</i>
<i>Recommendation 10.2: Evaluate aerial apparatus to determine which type(s) are best suited for the various response areas in the city.</i>	<i>217</i>
<i>Recommendation 10.3: Plan for significant fire station maintenance and renovations in the coming years. ..</i>	<i>217</i>
<i>Recommendation 10.4: Identify locations for future new or relocated fire stations.</i>	<i>217</i>
Conclusion	222
Appendix A: Survey of Worcester Residents	223
Appendix B: Survey of Worcester Businesses	229
Appendix C: Survey Worcester Firefighters.....	234
Appendix D: Table of Figures.....	245

Executive Summary

Master Plan

In March 2020, the City of Worcester contracted with Emergency Services Consulting International (ESCI) to conduct a Fire Department Master Plan, Community Risk Assessment: Standards of Cover, and a Strategic Plan for the Worcester Fire Department. This process was initiated by the City Manager and his team to identify the operational and cultural elements within the Worcester Fire Department that led to nine line of duty deaths since 1999 and to create a plan to prevent such events from occurring again. The purpose of the Master Plan was to provide the Worcester Fire Department with a detailed and comprehensive assessment of the fire department by quantifying its current service to the community, evaluating service delivery and response performance, soliciting public opinions through surveys and open forums, identifying forecast growth and resultant future service demand, and developing strategies for meeting projected needs. This Master Planning Process is designed to answer three questions:

1. Where is our organization today? This is achieved via a detailed evaluation of the public safety agency as it is currently configured.
2. Where will we need to be in the future? This is based on ESCI's analysis of past and future population growth and forecast future service demand.
3. How will we get there? ESCI will Provide short- and long-range future strategies that are designed to address long-term, future needs.

Community Risk Assessment: Standard of Cover

In addition to the Master Plan, a Community Risk Assessment: Standards of Cover report evaluates the risks and hazards present within the community served, the types and numbers of resources required to mitigate these risks, and the frequency with which the identified risks are expected to occur. Once these risks and their associated impacts are categorized, the fire department's response performance, ability to muster specified numbers of firefighters to incident scenes based on the risk profile, and gap analysis based on industry standards are evaluated.

Strategic Plan

Finally, a Strategic Plan results in a three-to-five-year work plan, intended to guide the work effort of the entire organization toward accomplishing a common set of goals and objectives. The process includes representation from every major interest group from both within and outside of the department. The Strategic Planning process is tentatively scheduled to occur in fall of 2021.

Using the information contained within these reports, the Worcester Fire Department and the City will possess the pathways forward to improve the department in multiple ways. The purpose and intent of this report is to provide the City and its fire department with a plan to end the cycle of events that tragically led to nine firefighter line of duty deaths since 1999, as well as a guide for progressing into the future. While some recommendations may be achieved relatively quickly or easily, others may take several years to resolve. At its core, the culture within the Worcester Fire Department must change if anything is to improve. This will take sacrifice and commitment by all members and city leadership, particularly those in supervisory or leadership positions. Fire department members must hold themselves and each other accountable if this process is to be successful.

Project Timeline

The City of Worcester contracted with ESCI in March 2020. The project was originally scheduled for completion within eight months; however, due to the impact of the COVID-19 pandemic and associated travel bans beginning in late March of 2020, the ability for contractors to travel from other states to Massachusetts was not possible. Additionally, with the closure of businesses and government facilities and a State of Emergency declared, the City and fire department were dramatically impacted for several months. Because an emergency of this nature and scale was unprecedented, and because all parties involved in this project felt that it was imperative for the project team to physically come to Worcester and meet with the members of the fire department in person, all work on the project was paused throughout the spring and summer of 2020.

In August of 2020, the report process was initiated with virtual meetings between ESCI and all fire department divisions. The project team began actively working on the project at this time and in November 2020, the first limited project team site visit was conducted. In February 2021, the entire project team conducted listening sessions at every fire station for all four fire department shifts. Following the listening surveys, ESCI offered firefighters an additional opportunity to provide input in the form an anonymous online survey that was completed in April 2021. In June 2021, the final draft report was submitted for review.

This report provides a comprehensive evaluation of the Worcester Fire Department. The next step in this process is for members of the fire department and other internal and external stakeholders to come together and identify the priorities, project teams, and associated timelines during the Strategic Planning process to begin to effect change within the fire department. It is essential that the fire department membership, union and department leadership, and city administrators work together for the common goal of improving the fire department. Change can only be achieved through compromise and shared goals, which will require concessions and compromise on all sides. The failure of any groups to concede, compromise, or advocate for the betterment of the organization will result in continuation of the current Worcester Fire Department culture and most likely a repetition of the past cycle of events. It is the sincere hope of ESCI that all members of the fire department and City leadership actively engage in joining together to effect a cultural change within the Worcester Fire Department.

Summary of Findings

The Worcester Fire Department Culture

A *cycle* is a “regularly repeated sequence of events.” In the case of the Worcester Fire Department, the “regularly repeated sequence of events” has created what is now the fire department’s culture. From the time a prospective firefighter enters the Civil Service System, Worcester firefighters are subjected to a series of obstacles, including inconsistent training, a lack of career development, varying levels of supervision and accountability, and the challenge of “shipping out” to different fire stations across the City where firefighters are required to mitigate emergencies while working with crews, apparatus, and equipment with which they are less familiar than if they had remained at their regular assignments.

ESCI held listening sessions in every Worcester Fire Station on all four shifts on February 23, 24, 25, and 26, 2021. Following the listening sessions, ESCI further solicited input from the Worcester firefighters by way of an anonymous electronic survey which was completed by 62.29% of the department (266 of the department’s 427 members). The results of the listening sessions were entirely consistent with the feedback that was returned in the survey: Worcester firefighters are demanding change within every level of their organization. During ESCI’s listening sessions, the majority of firefighters personally offered to be part of the process to make a change and improve the working conditions within their fire department. The results of the survey are included in this report as *Appendix C: Survey of Worcester Firefighters*.

ESCI notes that the Worcester Fire Department is an historically proud and traditional organization. As the department was officially established by the Massachusetts State Legislature on February 25, 1835, it has taken 186 years for the fire department to get to where it is today. While the current system cannot be completely changed overnight, ESCI suggests that the more aggressively City leaders work to change the current culture, the sooner firefighters will see improvements in their working conditions. ESCI offers ten opportunities within the Worcester Fire Department where the culture can—and should—be changed.

Figure 1. Opportunities to Change the Worcester Fire Department Culture

Opportunities to Change the Worcester Fire Department Culture

ESCI has identified ten *Opportunities to Change the Worcester Fire Department Culture*. These opportunities should become the foundation of a Long-Term Strategy for the future success of the Worcester Fire Department. Within each of the ten identified *Opportunities to Change the Worcester Fire Department Culture*, ESCI has further identified multiple specific recommendations that could be adopted to capitalize on the Opportunity.

The *Opportunities to Change the Worcester Fire Department Culture* are included in the *Opportunities and Recommendations* section of this report. Specific recommendations to work toward capitalizing on each of these opportunities are included within this section as well.

Opportunity 1: Fire Department Leadership Team

The Worcester Fire Department requires immediate intervention. It is ESCI's strong recommendation that the Worcester Fire Department create a temporary Assistant City Manager or Fire Commissioner position that is specifically tasked with overseeing all Fire Service Operations. The placement of this position within the City Manager's Office will ensure that the required changes are made in concert with the direction of the City Manager. ESCI further suggests that when the current Fire Chief retires, the Fire Chief Position remains vacant, and the Assistant City Manager or Fire Commissioner of Fire Service Operations be named interim Fire Chief until such time that there is a qualified candidate for Fire Chief within the Worcester Fire Department.

The ideal candidate for the temporary position of Assistant City Manager or Fire Commissioner tasked with overseeing all Fire Service Operations would be an experienced Fire Chief with a proven track record as a change agent. This individual should be familiar with the traditions of the New England Fire Service, be a willing and eager mentor, and possess outstanding communication and organizational skills.

Opportunity 2: Communication Network

Communication is a major deficiency within the Worcester Fire Department. It is imperative that a Fire Department Communication Plan be designed and implemented. The plan must identify the information to be shared with various and specific ranks of personnel within the department and by what means.

Opportunity 3: Chain of Command

The Chain of Command must be clearly identified, articulated, and consistently enforced within the Worcester Fire Department. The Leadership of the Worcester Fire Department reported to ESCI that they maintain an open-door policy that allows members of the fire department to talk to the Chiefs about anything at any time. While, in concept, this could be viewed as an effort to improve communications, special attention must be given to make sure that this policy does not lead to Chain of Command violations and opportunities to undercut company officers.

Opportunity 4: Rules & Regulations and Guidelines

ESCI's review of Worcester's *Rules and Regulations* and its *Guidelines* revealed a series of sections in both documents that are outdated, not in compliance with industry standards or best practices, and in direct conflict with other current Worcester Fire Department *Rules and Regulations, Guidelines*, or current practices.

The Worcester Fire Department must make it a priority to update its *Rules and Regulations* and its *Guidelines*. Accordingly, each company should possess a predetermined assignment prior to arriving on the scene, as well as a thorough understanding of company assignments for other arriving units based upon the order of arriving or as directed by the incident commander. Consequences for violating company assignments and breaching company integrity on scene must be clearly communicated, implemented, and sustained.

Scene accountability must be maintained at all times using a system that prevents responders from entering an environment that could be Immediately Dangerous to Life or Health (IDLH). This includes accounting for each individual firefighter, their rank, position on the apparatus, company, and assignment on the fireground prior to engaging in suppression activities using a recognized accountability system. Equipment placement on apparatus should be standardized. The Worcester Fire Department does not currently have a system that accomplishes this requirement. This lack of scene accountability is a fundamental element in the line of duty deaths Worcester Fire Department has experienced. Currently, the department is actively working to correct these issues; however, basic incident command training, such as the National Incident Management System (NIMS) Training provided online by the Federal Emergency Management Agency (FEMA), must be accomplished by all members of the department.

Opportunity 5: Training

There is no consistency within the Training Division. Firefighters are routinely assigned in and out of the Training Division as instructors. Depending on the personnel assigned to the division at any given time, the quality and duration of an initial firefighter recruit training program can vary greatly. The Worcester Fire Department must take steps to stabilize the Training Division, including succession planning and quality assurance programs to ensure that all recruit classes are consistently held to the same high standards. These training and performance standards should be transitioned to and upheld at the station level.

When the Training Division is conducting an initial firefighter recruit program, incumbent firefighter training is suspended. This is a disservice to the entire Worcester Fire Department. Immediate steps should be taken to add personnel to the Training Division to allow for simultaneous training of both incumbent and recruit firefighters or, alternatively, the Worcester Fire Department should consider outsourcing the training of recruit firefighters to the Massachusetts Firefighting Academy to allow the Worcester Training Division to focus its resources on incumbent firefighter training.

Opportunity 6: Promotional Process including Professional Development

There was a majority opinion from the members of the Worcester Fire Department that members were promoting too early with a lack of adequate experience for promotion. Three years to test for Lieutenant, one year in grade to test for Captain, and one year for District Chief were all deemed to be significantly insufficient.

Members found no fault with anyone taking the test because the system allows it. Contributors believed the times in grade needed to be expanded at each level to sit for the respective promotional exam, a career development path should be created to support those interested in promoting, and an experience period and should be established before a newly promoted member could act out of grade. There were multiple mentions of members promoting into a rank and immediately acting out of grade (i.e., Captain acting as District Chief within a few shifts of being promoted to Captain). With the overall lack of professional development in the department, this practice immensely increases the overall risks of a fireground operation.

The Worcester Fire Department must establish minimum criteria to determine time in grade, education, certification, competency, and professional development requirements for each position prior to allowing any individual to promote or work out of class in a temporary assignment. This could be accomplished through internal training requirements, an assessment center, or a combination thereof.

Officers who fail to learn leadership skills are challenged almost immediately upon promotion. The Worcester Fire Department stands to gain significantly from the development and implementation of a Professional Development Program.

Opportunity 7: Recruitment, Application, and Hiring Process

The Worcester Fire Department should customize the Civil Service process to better assess an applicant's candidacy for the specific position of Worcester firefighter instead of using the current generic process. Adding additional requirements can bolster candidate selection and better match the needs of the Worcester Fire Department.

Opportunity 8: Operational Staffing

ESCI recommends that all engines and ladder trucks be staffed by a minimum of four personnel consisting of at least one officer and with no more than one out-of-class assignment per company.

The Worcester Fire Department should take steps to determine the cause of and reduce the practice of "shipping out" to different fire stations across the city where firefighters are required to mitigate emergencies while working with crews, apparatus, and equipment with which they are less familiar than those to which they are regularly assigned. When all personnel are on duty for their regularly scheduled shift, there is no need to ship firefighters out to other stations; however, various elements and conditions have led to this practice being regularly required. By identifying the root causes for this issue, the practice of shipping out can be greatly reduced. At a minimum, the Worcester Fire Department should strive to maintain 75% crew integrity for crews of four personnel.

Opportunity 9: Support Services Staffing

All of the Support Services Divisions—Training, Fire Prevention, and Maintenance—are understaffed and will require additional personnel in order to satisfy their core missions. Additionally, fire department management must have the ability to select and retain qualified personnel in these divisions to ensure continuity of operations and allow for succession planning.

Opportunity 10: Emergency Response Deployment

There exist within the Worcester Fire Department many opportunities to improve emergency response deployment. The City of Worcester is growing and changing; the fire department must adjust its operations to meet the resulting changing service demands of the city.

Consideration should be given to whether the City has the appropriate number of fire stations in the appropriate places, whether the design of those fire stations facilitates efficient firefighter response, the geographical response districts, and workloads of each crew, and whether or not the appropriate type and number of resources are being sent to the various types of calls to which the fire department responds.

The Worcester Fire Department should use the updated Community Risk Assessment to prepare standard response protocols inherent to the community. The protocols should delineate the number and type of crews and the total number of firefighters to be deployed for each response based on the risk event to which they are responding.

For the purposes of long-term planning, Emergency Response Deployment includes planning considerations for buildings, apparatus, and equipment.

The Strategic Plan

ESCI recognizes that this report contains a multitude of recommendations that cannot all be accomplished simultaneously. The Worcester Fire Department has already contracted with ESCI to facilitate a Strategic Plan with the Worcester Fire Department Stakeholders.

The Strategic Planning process will ideally result in a three-to-five-year work plan intended to guide the work effort of the entire organization toward a common set of goals and objectives. The process should include representation from every major interest group in the organization. Each person in the Worcester Fire Department should feel that their interests are represented by someone in attendance on the planning team.

The ten *Opportunities to Change the Worcester Fire Department Culture* were intentionally designed with the idea that they could become the *Major Initiatives* within the upcoming Worcester Fire Department Strategic Plan. Following the adoption of the *Worcester Fire Department Master Plan*, or a variation of this master plan, the Worcester Fire Department should assemble an internal Strategic Planning Team to review the findings, identify and prioritize work, and establish the major initiatives to be addressed by the Strategic Plan. ESCI recommends that the Strategic Planning Team should be comprised of a combination of members who are elected by their peers, members who are appointed by the fire department, and members who are appointed by the union.

The Strategic Planning process divides the work into smaller components for accountability and to ease implementation. Once a Strategic Plan is created and adopted, the elements are divided among smaller task teams created from members of the organization, which results in additional buy-in. ESCI's experience is that Strategic Planning helps an organization focus efforts and avoid distractions outside of the goals, objectives, and priorities identified through the planning process. Budgeting should also align as much as possible with the implementation of the Strategic Plan.

ESCI underscores the importance of the Strategic Planning Process in moving the Worcester Fire Department forward. The flow of information within the Worcester Fire Department has typically been from the top-down. In order to effectively implement many of the recommended initiatives, there must be a strong flow of information from the bottom-up. ESCI suggests that Worcester's frontline firefighters are the best-positioned to contribute their daily work experiences and knowledge to this important next step for the Worcester Fire Department.

The Need for Collaboration

Breaking the *Worcester Fire Department Cycle* in as many places as possible is going to be a task that requires a significant amount of collaboration between labor and management. Progress within the Worcester Fire Department cannot and will not happen without the collaborative efforts of both management and labor. Conversely, either party could independently stop the entire process by becoming an impediment to implementing recommendations provided within this report, resulting in the cycle of line of duty deaths needlessly continuing.

While ESCI has identified a number of areas within the Worcester Fire Department where increased staffing and resources will assist the department in meeting industry standards and best practices, ESCI has also identified the need for labor and management to negotiate contract language that allows the leadership within the Worcester Fire Department to exercise appropriate authority to address issues within the fire department that could be a detriment to the safety of the Worcester firefighters and the community they serve.

The future success of the Worcester Fire Department is entirely dependent on the ability of labor and management to work together for the greater good.

Acknowledgments

In memory of the Worcester firefighters who made the ultimate sacrifice.

Last Alarm: December 3, 1999

Lieutenant Timothy Jackson, Sr.

Lieutenant James Lyons, III

Lieutenant Thomas Spencer

Firefighter Paul Brotherton

Firefighter Jeremiah Lucey

Firefighter Joseph McGuirk

Last Alarm: December 8, 2011

Firefighter Jon Davies

Last Alarm: December 9, 2018

Firefighter Chris Roy

November 13, 2019

Lieutenant Jason Menard

Emergency Services Consulting International Team

Mary-Ellen Harper, *Director of Operations*

Stuart McCutcheon, *Director of Business Intelligence*

Andrea Hobi, *Business Manager*

David Downey, *Associate*

Otto Drozd, *Associate*

Stuart McElhaney, *Associate*

Dr. Lori Moore-Merrell, *Associate*

Jason Smedick, *Associate*

John Tippet, *Associate*

Christopher Zak, *Associate*

Introduction

The City of Worcester contracted ESCI to develop a Community Risk Assessment: Standards of Cover, Fire Department Master Plan, and Fire Department Strategic Plan on March 3, 2020. Phase I of this Project is the Community Risk Assessment: Standards of Cover and Fire Department Master Plan. This phase of the project had three primary deliverables:

1. **Evaluate current operational service delivery.** Using information provided by Worcester Fire Department, ESCI was tasked with establishing an informational baseline, benchmarking emergency operations performance, and providing a detailed analysis of existing conditions and emergency operations.
2. **Identify future service delivery needs.** ESCI was tasked with providing a basic Community Risk Assessment to identify potential service gaps and redundancies, considering community expectations, needs, and resources.
3. **Provide recommendations for operational service delivery.** ESCI was tasked with developing recommendations to improve and enhance emergency services delivery for both the intermediate, short-term, and long-term. Where possible, recommendations were to include consideration of cost/benefit analysis, benchmarks, standards, and best practices.

Phase II of this project is the Strategic Plan which is scheduled to follow the Community Risk Assessment: Standards of Cover and Fire Department Master Plan.

Project Methodology

Using organizational, operational, staffing, and geographic information system (GIS) models, this evaluation provides a comprehensive appraisal of the Worcester Fire Department's operations as found upon ESCI's completion of fieldwork and data collection in May 2021. ESCI based this evaluation on data provided by the City and collected during ESCI's fieldwork. The information is evaluated against a combination of Massachusetts state laws and regulations, National Fire Protection Association (NFPA) standards, Commission on Fire Accreditation International (CFAI) self-assessment criteria, health and safety requirements, federal and state mandates relative to emergency services, and generally accepted best practices within the emergency services community, as well as the experience of ESCI's consultants.^{1,2} Each section in the following report provides the reader with general information about that element, as well as observations and analyses of any significant issues or conditions.

¹ NFPA, National Fire Protection Association is a standard developing organization. Standards developed by NFPA are "voluntary consensus standards," created through procedures accredited for their consensus decision-making, openness, balance of interests represented, and fairness by the American National Standards Institute (ANSI).

² The CFAI organization is now a subsection of the Center for Public Safety Excellence (CPSE) but maintains its prime function of accrediting fire agencies.

Evaluation of Current Conditions

The project begins by setting forth the current conditions within the Worcester Fire Department. The purpose of this section is two-fold. First, it verifies the accuracy of baseline information along with ESCI's understanding of the Worcester Fire Department's composition. This provides the foundation from which the Community Risk Assessment: Standards of Cover and Master Plan are developed. Secondly, the overview serves as a reference for the reader, who may not be fully familiar with the details of the WFD's operations. Where appropriate, ESCI includes recommended modifications to current observations based on industry standards and best practices.

Review of Draft Report

ESCI conducted a Draft Report Review Workshop for the Worcester Fire Department on Thursday, September 2, 2021. The workshop was held at 9am at the Regional Emergency Communications Center, 2 Copping Drive in Worcester. ESCI's facilitators presented an overview of the draft report and provided an opportunity for workshop participants to ask questions. All of the workshop participants were then asked to validate that the current conditions of the Worcester Fire Department listed in the report were accurate to the best of their knowledge. They were further asked to return written comments or corrections to Deputy Assistant City Manager Nicole Valentine on or before 4pm on Friday, September 10, 2021.

The following members of the Worcester City Manager's Office, Worcester Fire Department Command Staff, and IAFF Local 1009 were in attendance at the Draft Report Review Workshop:

Figure 2. Stakeholder Input

Name	Rank
Gary Arpin	District Chief
Ed Augustus	City Manager
Michael Baer	Lieutenant / Executive Board Member IAFF Local 1009
Eric Batista	Director of Innovation
Terrence Baudin	Captain / Vice President IAFF Local 1009
Matthew Braley	District Chief
Mark Cady	Lieutenant / Executive Board Member IAFF Local 1009
Robert Courtney	District Chief
Martin Dyer	Deputy Chief
Jason Ehrets	District Chief
Michelle Esposito	Supervisor of Administration
Thomas Fitman	Lieutenant / Secretary-Treasurer IAFF Local 1009
Gary Fleischer	District Chief
Michael George	Lieutenant / Executive Board Member IAFF Local 1009
David Grilla	District Chief
Anthony J. Grokaitis	District Chief of Training
Kathleen G. Johnson	Assistant City Manager
Joshua Martunas	Program Manager
Daniel O'Neil	District Chief
Michael Papagani	Lieutenant / President IAFF Local 1009
John Powers	Deputy Chief
Kurt Richard	District Chief
Sam Richesson	District Chief
Adam Roche	District Chief
Charlie Rogacz	District Chief
Nicole Valentine	Deputy Assistant City Manager
Thomas Valentine	Firefighter / Executive Board Member IAFF Local 1009

Stakeholder Input

The ESCI project team conducted more than seventy-five separate virtual and in-person interviews, meetings, and facility tours to gather information from key stakeholders to provide context for the recommendations that are identified within this study. The purpose of these interviews, meetings, and surveys was to gain an understanding of the current issues, concerns, and opinions related to the emergency services delivery system within the Worcester Fire Department. General topics discussed during each interview included:

- Perceived strengths and weaknesses of the current system.
- Identified strengths and weaknesses of the current system.
- Opportunities for enhancement to the current system.
- Future challenges that may warrant attention.

ESCI's interviews with Worcester Fire Department stakeholders included, but were not limited to, the following individuals:

Figure 3. Stakeholder Input

Stakeholder Interviews	
Family Representatives of some of Worcester's Fallen Firefighters	
Fire Department Executive Staff	
Fire Department Division Heads	
Uniformed Members of the Worcester Fire Department	
Worcester Firefighters IAFF Local 1009	
Community Members	
City of Worcester Elected and Appointed Leaders	
City Directors and Key Staff	

Internal Stakeholder Input

In-station interviews were scheduled to obtain input from the rank and file as part of ESCI's assessment of the Worcester Fire Department. The schedule involved visiting various fire station work sites for periods ranging from not less than one hour to over two hours. An unstructured interview approach was used. The interviews opened with the interviewers introducing themselves and providing some background on the project. Three ice-breaking questions were developed to encourage discussion. These questions included:

- "What is going well?"
- "What could be improved *and* what are the solutions to what needs to be improved?"
- "What would be your top priority if it was your department to run?"

Interviewees were encouraged to be candid, assured identities would be kept confidential, informed comments would be grouped thematically as themes emerged, and no subject was off-limits. The ice-breaking questions listed above were rarely invoked as the interviewees in nearly all visits were comfortable discussing their impressions of Worcester Fire Department operations. The groups had varying degrees of the scope of the project. Some were better informed than others. As an example of the level of candor encountered, some members welcomed the opportunity to speak about the department from their view.

Seven major themes emerged from the conversations. They are outlined as follows.

Staffing

Staffing, in particular four-person staffing for companies and short staffing in other divisions, including Administration, was the primary discussion point of all meetings. It was a concern raised by members of all ranks. There was unanimous consensus that four-person staffing on apparatus was the top priority among the rank and file for improving safety, efficiency, and service to the community. Members cited NFPA 1710: *Standard for the Organization and Deployment of Fire Suppression Operations, and Special Operations to the Public by Career Fire Departments* (NFPA 1710), and anecdotal experience with operating using three and four-person crews.

Engine company officers unanimously voiced the adverse impact of operating with three-person companies (officer, driver, firefighter), citing how their supervisory capabilities and situational awareness are severely impacted when they must physically participate in advancing hose lines, communicate with command, and attempt to monitor fire conditions.

Truck company officers noted that the basic tenet of operating in teams of two (inside and outside) could not be fulfilled when the truck company is only staffed with an officer, driver, and firefighter.

Short staffing in other divisions (Training and Fire Prevention in particular) was also noted for the impact it has on providing Field Operations with training and fire prevention support.

Accountability

Mentioned equally as many times as staffing, accountability at all levels of the Worcester Fire Department is a much-desired organizational cultural attribute that was repeatedly requested. Members perceive that repeated failures to follow guidelines and directives on the incident scene were not addressed by District Chiefs and Administration. This has created an air of impunity by those who are intentionally committing the infractions. Members further believed that those making mistakes do not receive coaching, which results in the bad practices going uncorrected.

Members felt that the lack of accountability goes beyond the incident scene, which allows for lack of personal accountability as well as a lack of professional approach to the job. Members who believe that they hold themselves to a high standard have become frustrated by what they perceive as the Administration's lack of issuing discipline to maintain order within the department. These members further believe that the haphazard application of, and in some cases complete lack of, disciplinary action is detrimental to morale and the moral fiber of the department.

Communication

There was universal frustration voiced over the number of initiatives launched over the last several years with a perceived shortage of background information to communicate "the why." The consensus among those interviewed was that the communication chain in the department is broken, causing even the best of intended programs to fail, or be undermined due to a lack of explanation of the purpose, need, or vision. Examples cited include the concept of transitional attack (interpreted to be applied in all situations and enacted to eliminate the interior attack), large-diameter supply lines (bewildering due to the Worcester water system being very reliable), a commitment to maintaining four-person staffing on truck companies (perceived to have just been forgotten/ignored), and Blue Card Command (training not completed, but members using terminology on the street unfamiliar to others leading to confusion on the incident scene). Members also noted they rarely see a ranking member above their respective District Chief, and District Chiefs frequently roll out new initiatives under the auspice of "This is what *they* want us to do." Senior Staff is only visible in the rank and file's eyes when something is going wrong.

Multiple members expressed anger, frustration, and disappointment over the lack of communication surrounding Board of Inquiry reports from the Firefighter Christopher Roy and Lieutenant Jason Menard line of duty deaths not being released to the membership. There was an acknowledgment of Christopher Roy's death being attached to a criminal investigation, but the consensus was that the command and control, and strategy and tactics issues should be able to be shared with the department. There was a perception among many of those who spoke to ESCI that the Roy Inquiry might have contained information that could have prevented the Jason Menard line of duty death. There is a current concern that the Jason Menard Inquiry may contain information that could potentially prevent the next line of duty death.

Training

Field perception of the Training Division is that it is staffed at a level where the Division can only concentrate on one initiative at a time. This strangles its ability to serve the department in total, according to the members interviewed, some of whom had been assigned to Training.

The Division currently spends nearly all its time on the recruit class process and program. The cycle of hiring provides the assigned staff approximately 60 days after a class graduates to take vacation, concentrate on incumbent initiatives, and prepare the drill field for the next class before staff begins the hiring process all over again. This style of operation leaves the department at a severe disadvantage for essential incumbent initiatives, including driver training, pumps and hydraulics, truck company operations, officer development, and in-service training.

Multi-company drills are infrequent. However, they received high praise from the interviewees when they are conducted. The consensus among the various groups interviewed is the Training Division is working as hard as it can but needs additional personnel to fully serve the department and improve performance.

Experience

The topic of “experience” dominated conversations throughout the week of site visits. “Experience,” as understood by the members of the Worcester Fire Department, referred to the number of fires a member had been to, time in grade beyond the benchmarks in force today (i.e., three years for first promotion), and organic leadership capabilities.

There was a majority opinion that members were promoting too early with a lack of adequate experience for promotion. Three years to test for Lieutenant, one year in grade to test for Captain, and one year for District Chief were all deemed to be significantly insufficient. Members found no fault with anyone taking the test because the system allows it. Contributors believed the times in grade should be expanded at each level to sit for the respective promotional exam, a professional development path should be created to support those interested in promoting, and an experience period needed to be established before a newly promoted member could act out of grade. There were multiple mentions of members promoting into a rank and immediately acting out of grade (i.e., Captain acting as District Chief within a few shifts of being promoted to Captain).

A number of those interviewed noted that the professional development process is completely at the whim and caliber of the officer for which the aspiring member works. Interviewees pointed out this leads to some members promoting with good skill sets and others inadequately prepared to assume a leadership role.

Morale

Low department morale was cited as a problem in many of the station visits. The irony of the low department morale issue was that morale at the company/station level was consistently perceived as being high. The most frequently mentioned contributors to low morale at the department level were the “knee jerk” reactions by the Administration; i.e., programs implemented to address an issue, but not reinforced or institutionalized three to six months after rollout, the reported labor/management challenges with immovable stalwarts on both sides, the failure to release the Boards of Inquiry reports from the Roy and Menard Line of Duty Deaths discussed previously, the practice and amount of “shipping out” that occurs on the day of work, and the lack of crew continuity due to the amount of shipping out.

Standardization

There was an overwhelming call for standardization within the Worcester Fire Department. Members felt that there was progress in this area with the latest apparatus purchases but indicated there were other areas where operational efficiency and accountability could be improved. Recommendations for standardization included: standard apparatus check sheet for all apparatus, standardized equipment, and standardized on-scene operations.

External Stakeholder Input

Due to COVID-19 restrictions, in lieu of holding community forums, ESCI team members conducted two separate electronic surveys for the residents and business owners within the City of Worcester to determine internal, external, and policy-maker expectations of the Worcester Fire Department.

In order to solicit input from the Worcester Community, ESCI created a nine-question online survey. The resident and business surveys were both open for participation from October 1 to 31, 2020. The Worcester Fire Department posted the link to this survey on the department website and shared information about the survey through its other normal communication channels. A total of 243 residents and two business owners initially completed the online surveys. In an effort to obtain more input from the Worcester Business Community, the Business Survey was re-opened from March 4, 2021, to April 1, 2021. When the Business Survey was closed the second time, a total of 43 business owners had participated. The returned responses do not comprise a significant percentage of the overall population of the Worcester Community.

Those who participated in both the Worcester Fire Department Resident and Business Owner Surveys were, in general, very pleased with the services offered by the fire department. This is a credit to the men and women of the Worcester Fire Department, who provide consistently high levels of service to the community every day.

An overwhelming majority of survey participants felt that Fire Suppression services were “critical;” 90% of the residents considered Fire Suppression to be critical, while 74% of the business owners classified it as such. This is an indication that the services provided by the fire department are valued by the community.

The majority of the residents (63%) felt that the fire department was understaffed while 34% felt that it was appropriately staffed. When asked the same question, 33% of the business owners believed that the fire department was understaffed, and 55% felt that it was appropriately staffed. Only 3% of residents and 4% of the business owners felt that the fire department was overstaffed.

In general, the people who participated in the External Customer Assessment Survey valued the service that is offered by the fire department. Survey participants used the words “always there for us,” “loved,” and “professional” to describe their firefighters. Both residents and business owners expressed repeated concerns about the health and safety of their firefighters, specifically as it relates to preventing line of duty firefighter deaths. The work done by the men and women of the Worcester Fire Department has not gone unnoticed by their community.

ESCI notes that while in many cases, the survey respondents were very well-versed about fire service industry standards and best practices, that there were also multiple requests throughout the surveys for additional information about the fire department and its operations. ESCI suggests that this indicates interest among both the residents and business owners to know more about the operations of their fire department in an effort to ensure that firefighters have the necessary resources to perform their jobs safely. This presents an opportunity for the Worcester Fire Department to provide more community outreach to engage the residents and business owners within the City of Worcester.

The Survey of the Worcester Residents and a detailed breakdown of the results for each question are included in this report as Appendix A and the Survey of Worcester Businesses is included in this report as Appendix B.

Organization Overview

The Organization Overview component provides a summary of agency composition, configuration, and services provided. Data provided by the administrative and management staff of Worcester Fire Department were evaluated. In addition, interviews with line personnel, bargaining unit representatives, supervisory and administrative staff, and City administration were combined with information collected in the course of ESCI's fieldwork to develop the following overview.

Service Area Population & Demographics

The City of Worcester is located in the Commonwealth of Massachusetts. It was incorporated as a Town in 1722 and as a city in 1848. According to the 2019 American Community Survey 1-Year Estimates Data Profile from the U.S. Census Bureau, the population is (+ or - 41) 185,421.³ Worcester is the seat of Worcester County and is approximately 40 miles west of Boston. According to the U.S. Census Bureau, the City has a total area of 38.45 square miles, of which 37.36 square miles is land and 1.08 square miles is water.⁴

The Worcester Fire Department service area is made up of a population with a median age of 34.9 years old. According to the 2019 ACS 1-Year Estimates Data Profile, the median income level is \$57,092.⁵ Data from the same table indicates the U.S. median individual income was \$65,712. Specific population risk factors are children 5 and under (5.2%) and adults 65 and older (13.2%).

The U.S. Census shows the racial makeup of Worcester is predominately White (72.4%), Hispanic (23.1%), Black or African American (15.2%), American Indian (0.7%), Asian (9.8%), Pacific Islander (0.3%) and 1.6% of other races.

³ https://data.census.gov/cedsci/table?q=United%20States&g=0100000US_352M300US796002582000&tid=ACSDP1Y2019.DPo5&hidePreview=false

⁴ https://www2.census.gov/geo/docs/maps-data/data/gazetteer/2019_Gazetteer/2019_gaz_place_25.txt

⁵ https://data.census.gov/cedsci/table?q=United%20States&t=Income%20and%20Poverty&g=0100000US_352M300US796002582000&tid=ACSST1Y2019.S1903&hidePreview=false

The City of Worcester's well-educated population contributes to lower risk factors; 56.2% of the population is made up of persons 18–24 years of age having some college education, and over 42% of the population is made up of persons 25–34 years of age having completed a bachelor/graduate level or other professional degrees. However, a large population of the City also lives in poverty resulting in an unemployment rate of 7.6% and a median household income of \$46,407⁶, risk factors increase.

History, Formation, & General Description of Worcester Fire Department

In the late 1700s, the Worcester Fire Society was formed, and their actions led to the purchase of the City's first fire engine in 1793. By 1828, Worcester had four, all volunteer, engine companies. On February 25, 1835, the Worcester Fire Department was officially established by an act of the state legislature. In May of 1835, the Board of Selectmen appointed the first Board of Engineers for the fire department. The efforts of the volunteers were channeled into the fire department, which was directly under the control of the city government.⁷ The City of Worcester was one of the first to pay its firefighters.

Worcester Fire Department has contributed to the tradition and legacy of the American Fire Service since its beginning. Worcester firefighters helped extinguish the Great Boston Fire of 1872, and the first brass sliding pole used in the United States was installed in a Worcester firehouse in 1880. By 1935, the Worcester Fire Department consisted of 10 engine companies, 10 ladder companies, and 10 hose wagons.

Current Service Delivery Infrastructure

Today, Worcester has 13 engine companies, seven ladder companies, one heavy rescue company, three other cross-staffed specialty units, an incident safety officer, and two command units distributed amongst 10 fire stations. The mission of the fire department is to protect the lives and property of the residents, businesses, and visitors of Worcester from the adverse effects of fire, medical emergencies, or any other hazardous condition, whether natural or caused by people.⁸ The City has approved the 2021 Annual Budget totaling \$41,261,167 to fund the accomplishment of this mission. It includes funding for Capital Projects, Salaries and Overtime for 422 positions, and Ordinary Maintenance.

Governance & Lines of Authority

The Worcester Fire Department is a division of city government, accountable to a popularly elected Mayor, 10 City Council Members, a City Manager, and more than 185,000 residents, all with various perspectives. Department leaders approach stakeholders with immediacy, believing that when citizens have easy access to information, they can lead healthier, safer lives.

⁶ <https://www.census.gov/quickfacts/fact/table/worcestercitymassachusetts,US/INC110218>

⁷ <http://www.worcesterma.gov/fire/about-us/history>

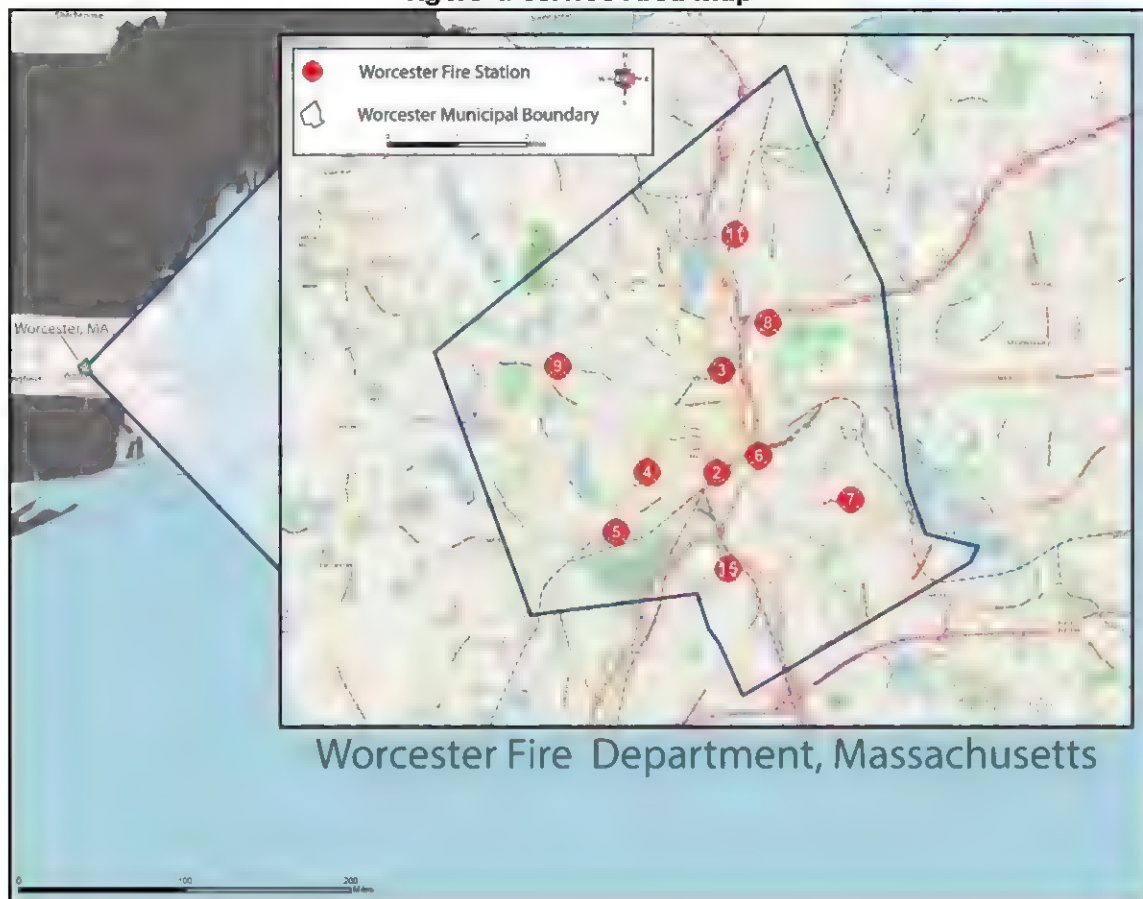
⁸ <http://www.worcesterma.gov/uploads/oe/4a/oe4a2cac9449b9df91a85ea87437do37/budget-fy21.pdf>

The City Council is the primary legislative and policy-making body for Worcester. There are six Councilors-At-Large elected by city voters to serve a two-year term, one of which is the city's Mayor. Additionally, there are five District Councilors representing one of the five districts that consist of two Wards each. They are nominated and elected by city voters from within their respective district to serve a two-year term.

The City Council's overall operating budget includes the City Manager and 24 departments and offices and is funded through the City's general fund revenues. These revenues come in three main forms: property taxes, state aid, and local receipts. Forty-five percent (45%) of city revenue comes from property taxes, 48% from State Aid—inclusive of city and education reimbursements, and 8% comes from local receipts such as vehicle excise, licenses, permits, and other charges.

Members of all boards and commissions classified as executive and regulatory are appointed by the City Manager. Confirmation by the City Council is not required for said appointments. Appointments to all boards and commissions classified as advisory are subject to confirmation, by majority vote, of the City Council. Though not limited to, the City Manager can make appointments to boards or commissions from a list of names submitted by the citizen advisory council.

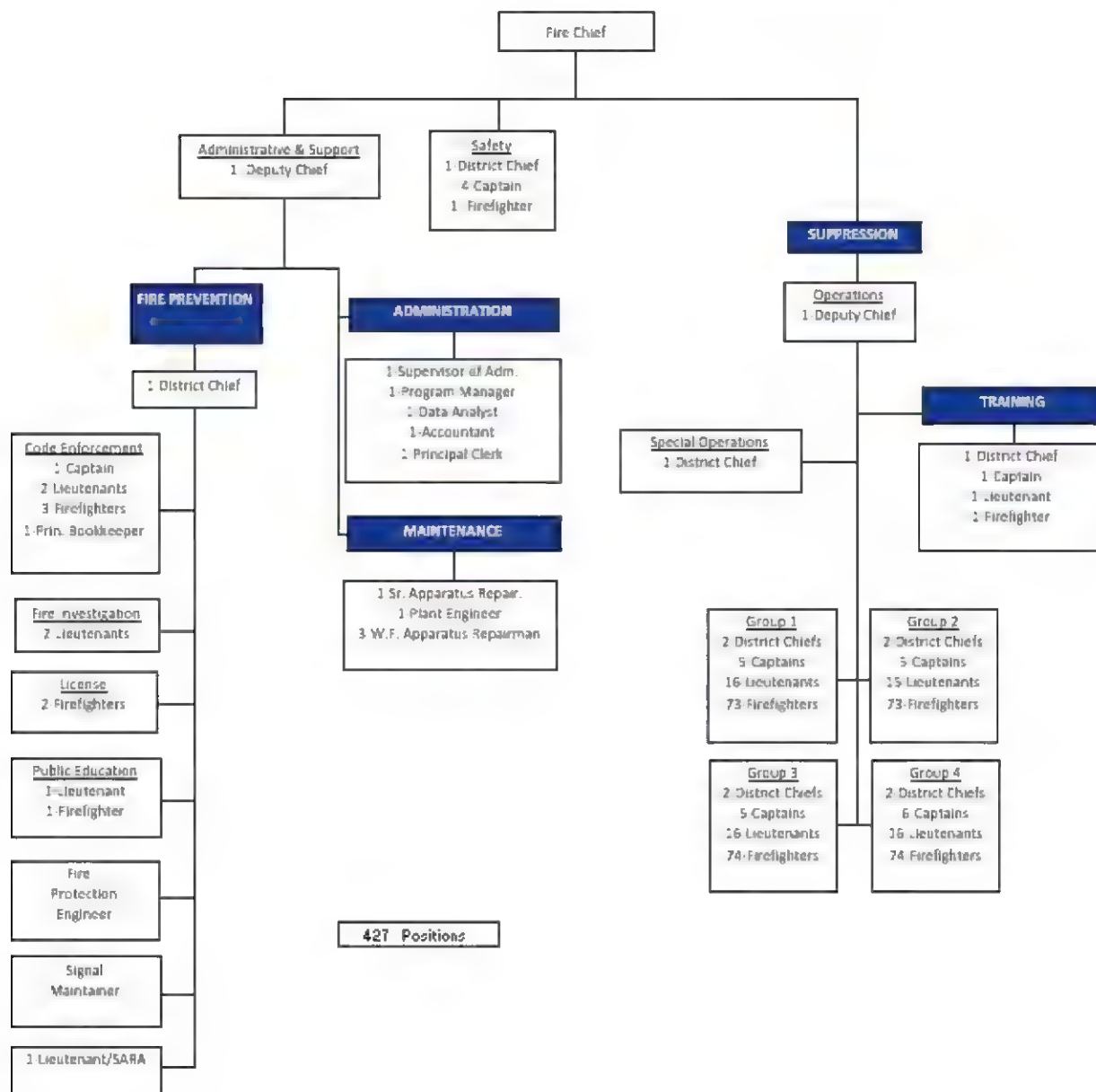
The City Manager position is the Chief Administrative and Executive Officer of the city responsible for the administration of all city agencies. The City Manager is responsible for implementing Council policies and directives, leading the preparation of the city budget, and overseeing daily operations for the various departments and divisions. Furthermore, the City Manager manages all city-owned public facilities, as well as their maintenance and safety. The following figure reflects the service area of the Worcester Fire Department.

Figure 4. Service Area Map

Organizational Design

The following figure illustrates the rank structure of the Worcester Fire Department.

Figure 5. Worcester Fire Department Organization Chart



Community Risk Assessment

This section analyzes risks present within the Worcester Fire Department service area that potentially threaten people and property within the City. These risks are identified to assist Worcester Fire Department in planning the location of response resources in the types and numbers necessary to effectively respond to likely emergencies. While not all hazards of individual occupancies can be considered—that is beyond the scope of the study—there are risks that seem to be relevant to the City. It is recommended that Worcester Fire Department know and rate the hazards and risks in terms of frequency and severity within the jurisdiction.

The next figure is one sample method of identifying and analyzing risks within a community.

Figure 6. Risk Identification and Analysis Process¹

Step	Action
Hazard Identification	Identify hazards.
	What is the probability this hazard will occur?
	Is this hazard a significant threat to your jurisdiction?
	Approximately how often does this hazard occur in your jurisdiction?
Vulnerability Assessment	For each hazard identified in the hazard identification process, consider each of the five factors. Factor 1: Danger/Destruction/Personal harm Factor 2: Economic Impacts Factor 3: Environmental impacts Factor 4: Social Impacts Factor 5: Political considerations
	Score the vulnerability from this hazard.
	Reconsider priority of each hazard based on vulnerability.
Risk Rating Score	$\text{Risk Rating} = \text{Probability}^2 \times \text{Vulnerability}^2$

¹ Adapted from the Community Risk Reduction Model – United States Fire Administration, National Fire Academy

² Probability and Vulnerability are rated as 3 = High, 2 = Moderate, 1 = Low

The fire service assesses the relative risk of properties based on several factors: the service area population and population density, the demographics of the population, local land use, development, and the geography and natural risks present within the community. These factors affect the number and type of resources (both personnel and apparatus) necessary to mitigate an emergency. Properties with high fire and life risk often require greater numbers of personnel and apparatus. Therefore, staffing and deployment decisions should be made with consideration to the level of risk within geographic sub-areas of a community.

Population and Population Density

An important aspect of classifying risk is to know where the population of a community is located. Community risk is assessed based on the total population and its distribution (normal, transitional, road miles, general, and different types of occupancies). The Worcester Fire Department's current service area population (2018) is estimated at 185,685.⁹

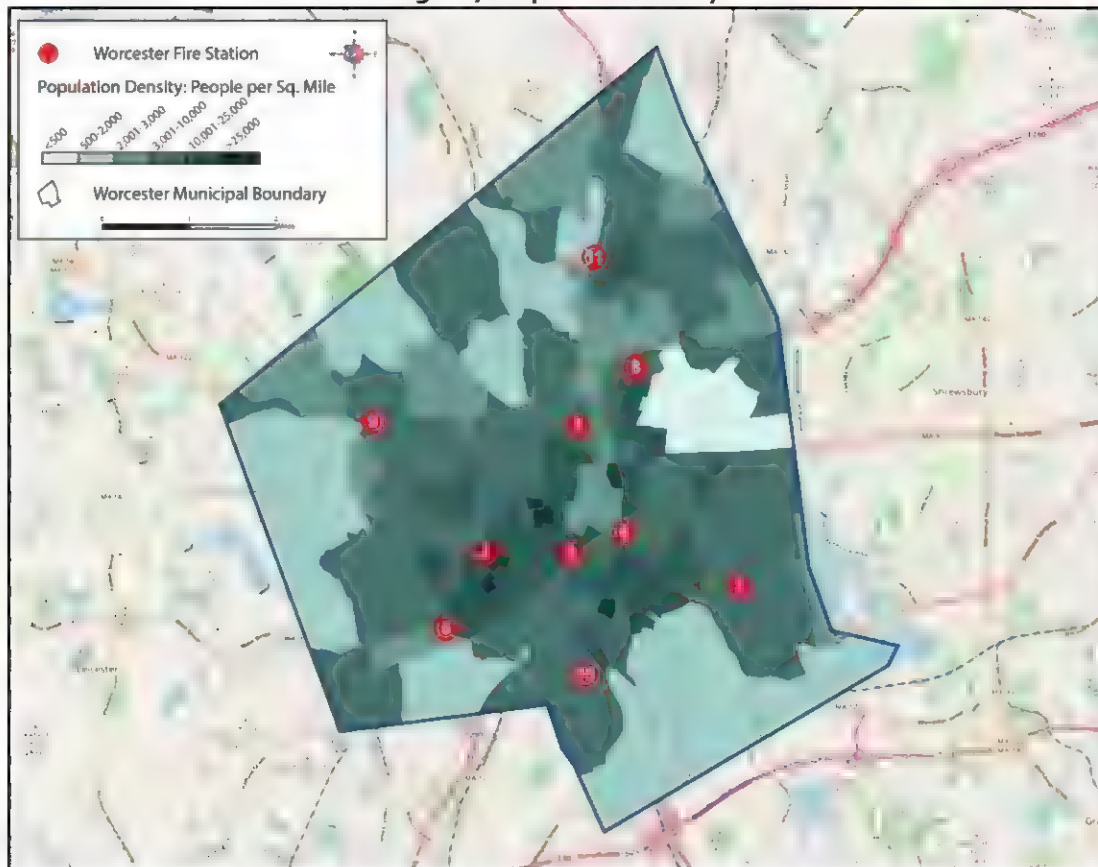
Population increases correlate to variations in population density or the population per square mile. Population density for the Worcester Fire Department's service area is comprised of:

- Dense Urban (> 3,000 people per square mile/a population > 200,000)
- Urban (> 1,000 people per square mile)
- Suburban (500–1,000 people per square mile)
- Rural (< 500 people per square mile)

The following figure provides population density by U.S. Census block groups, which are the smallest division used by the census.

⁹ https://data.census.gov/cedsci/table?q=United%20States&g=0100000US_352M300US796002582000&tid=ACSDP1Y2017.DPo5&hidePreview=true

Figure 7. Population Density

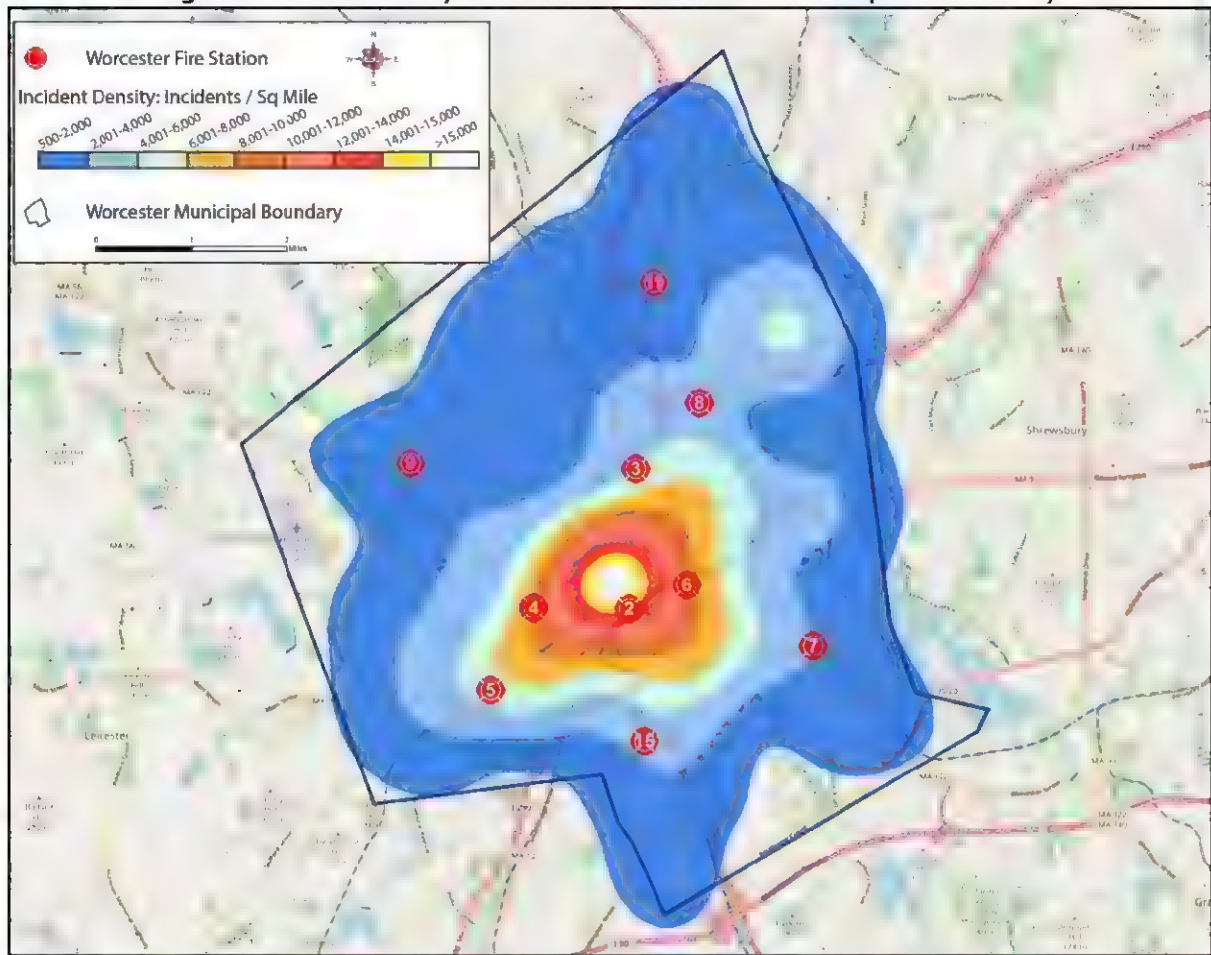


Population density varies slightly across the Worcester Fire Department service area. The overall population density of the City exceeds 1,000 persons per square mile, which meets the NFPA definition of an urban area. As the population in the City increases, the fire department may need to re-evaluate demographic and census data, adjusting response goals to meet future service demand adequately.

Population density (2018) is estimated to be 4,990.2/sq. mi. within the City's boundaries. Worcester is currently growing at a rate of 0.15% annually, and its population has increased by 2.98% since the most recent census, which recorded a population of 181,045 in 2010.¹⁰

Several relational factors are associated with a greater number of occupancies and residents within denser areas. Increased probabilities of emergency events or higher service demands can create reduced reliability of first-due and effective response forces (see Figure 8. Incident Density Relative to Station Location and Population Density). Consistent agency service will be impacted as well as travel time benchmark performance. Traffic flow constriction on major thoroughfares, especially when the tourist population is present, may create performance gaps. The Worcester Fire Department should consider partnering with the Massachusetts Department of Transportation to develop a traffic flow study for the City.

¹⁰ <https://worldpopulationreview.com/us-cities/worcester-ma-population>

Figure 8. Incident Density Relative to Station Location and Population Density

Commonly referred to as “Hot Spot Mapping,” this analysis calculates the areas of greatest demand based on the density of incidents within an area. This analysis does not indicate how many calls actually occurred within each ring but instead provides a way to compare each area to one another. In this analysis, each ring is calculated to display incidents per square mile and provides a range of how densely located calls for service were to each other.

Demographics

Community risk assessment includes information about the people who are impacted by, or a part of, the problem because risk is influenced by socioeconomic issues. A community demographic profile can be developed with accurate statistical data derived from the population. Causal factors and at-risk populations must be evaluated with consideration of the following:

- Social factors and cultural influences
- Economic factors
- Environmental elements
- Identification of risk factors in specific populations:

- Children (age 5 & under)
- Older adults (age 65 & older)
- People with disabilities
- People living in poverty
- Populations that speak English as a second language

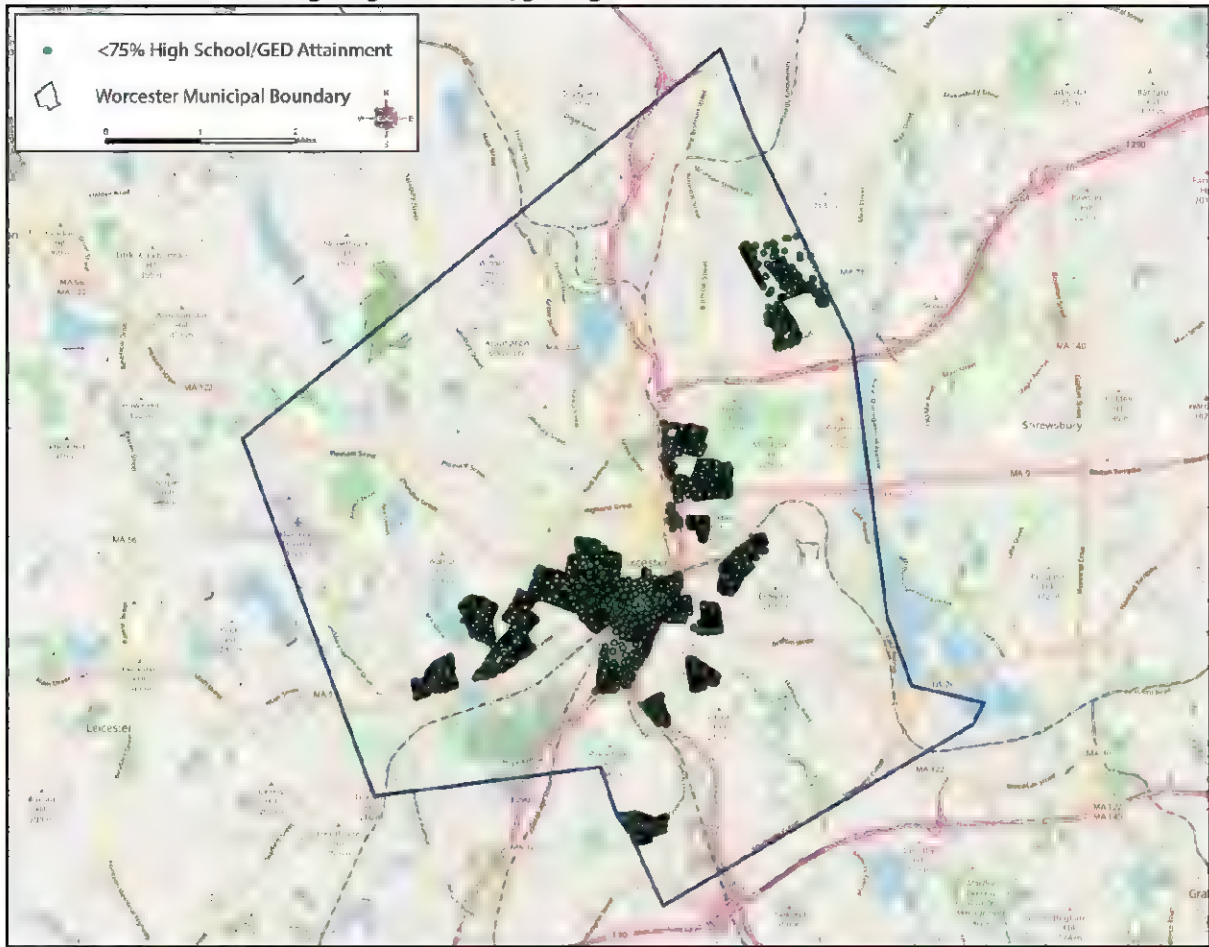
Unless otherwise noted, the following demographic information is sourced from the U.S. Census Bureau.¹¹

Education

The population within Worcester is educated but lower than that of comparable jurisdictions, with 84.7% of the population over 25 years of age possessing a high school diploma or higher, as compared to 90.8% of Massachusetts, and 87.7% of the U.S. The proportionate share of college educated citizens in the City is similar to the United States as a whole, with 30.2% versus 31.5% having a bachelor's degree, respectively.

¹¹ <https://www.census.gov/quickfacts/fact/table/MA,wocestercitymassachusetts/PST045219>

Figure 9. Less than 75% High School or GED Attainment

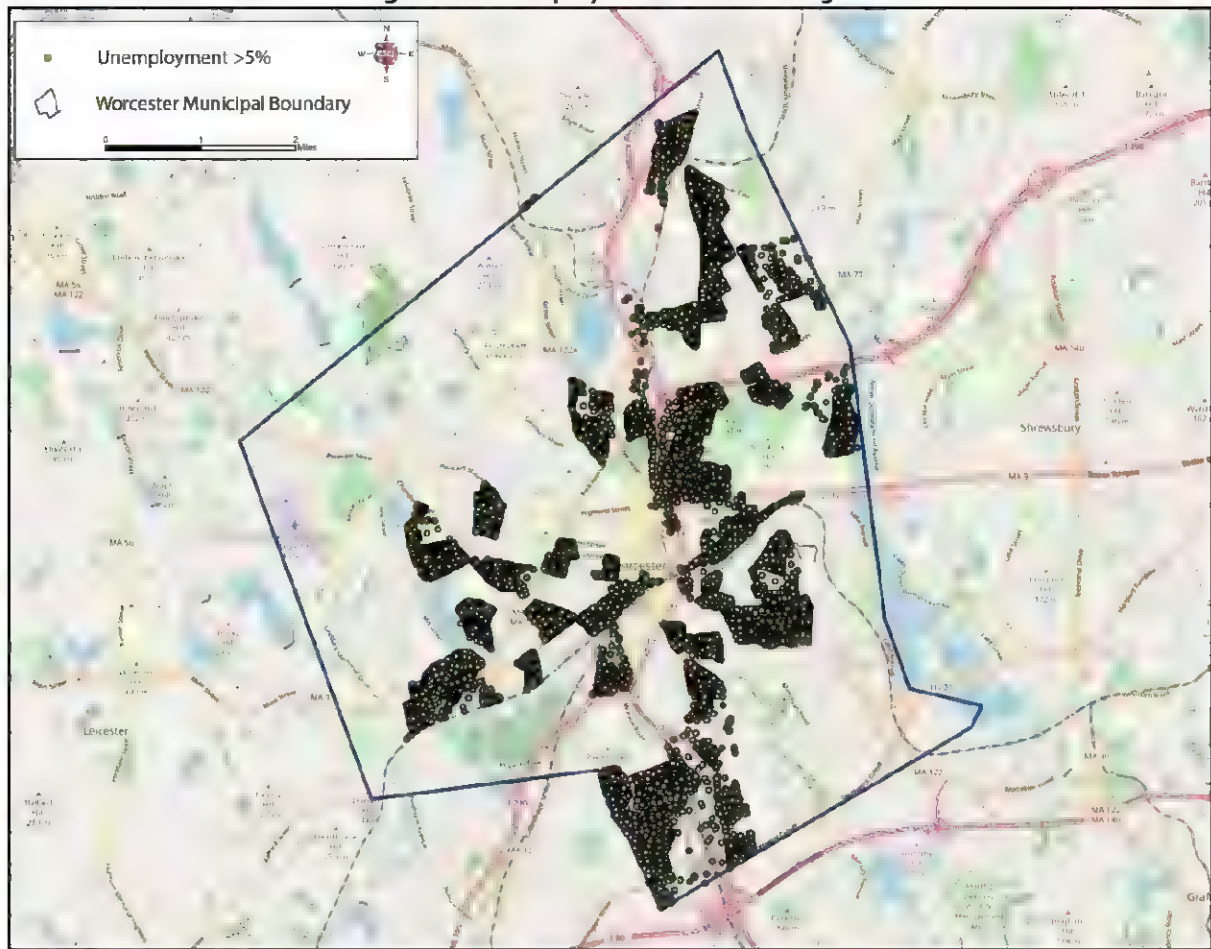


The concentration of people where the completion of a high school diploma or GED is less than 75% occurs mostly around the southern and western areas of downtown. When comparing these identified areas with the hotspot map in Figure 8, some correlation can be drawn between the greatest concentration of fire department incidents and where lesser educated populations reside. This provides Worcester Fire Department with a public education opportunity to assist the community in reducing fire risks and hazards.

Income and Unemployment

Worcester's median household income is \$46,407, which is lower than both the median income of Massachusetts, which is \$81,215, and the median household income within the United States, which is \$60,293. Additionally, the unemployment rate hovers around 7.6%, which is slightly higher than the rate for Massachusetts. The following figure provides the geographic distribution of areas within Worcester where unemployment is greater than 5%.

Figure 10. Unemployment Greater than 5%



Race and Ethnicity

The majority of the population of Worcester is white (72.4%) and English-speaking (65.4%). Although prevention and information materials written in English will reach most of the population, there is value in presenting risk reduction and prevention messages in Spanish as 23.1% of the community identifies as Hispanic or Latino. State-wide, 12.4% of citizens of Massachusetts report as being Hispanic or Latino.

Figure 11. Ethnic Groups of Worcester; American Community Survey 2019¹²

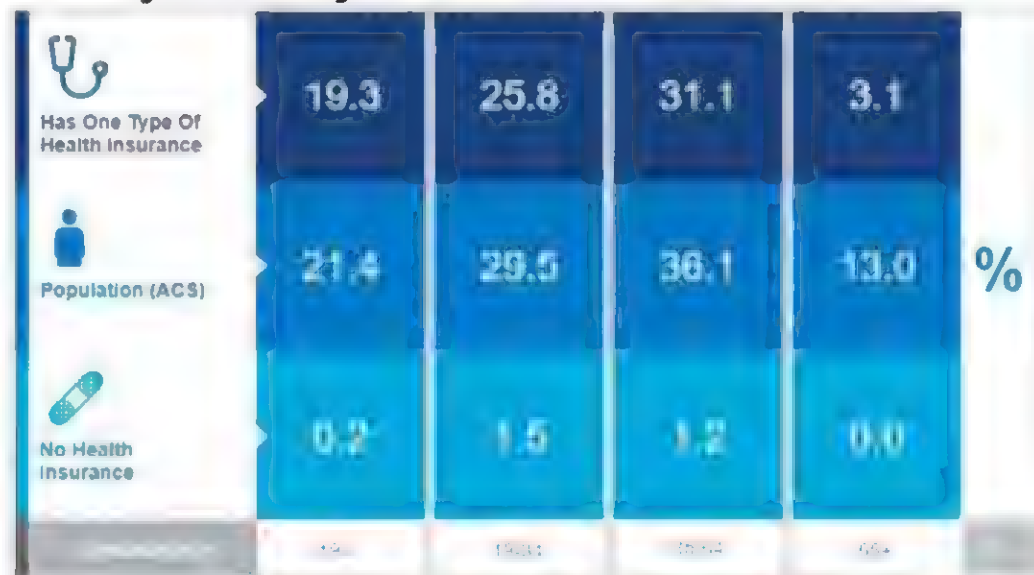
Race	Percentage or Total
White	72.4%
Hispanic or Latino	23.1%
Black or African American	15.2%
Asian	9.8%
Other	2.6%

¹² Estimates are not comparable to other geographic levels due to methodology that may exist between different data sources.

Health Insurance

Employed citizens have increased access to health insurance, and therefore receive preventative health care at higher levels. In Worcester, 2.9% of the citizens do not have access to health insurance, as opposed to 9.5% across the United States. The benefit of health insurance extends to the frequency of pre-hospital emergency medical incidents, as citizens with health insurance use primary health care providers over emergency room facilities at higher levels. The following figure depicts the percentage of residents with health insurance in Worcester.

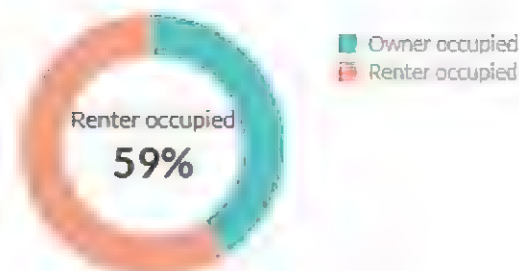
Figure 12. Percentage of Residents in Worcester with Health Insurance¹³



Home Ownership

There are 75,585 housing units in Worcester, and 41% are owner-occupied while 59% are renter-occupied. State-wide, owner-occupancy is significantly higher at 62%, and nationwide, owners occupy 63.8% of households.¹⁴

Figure 13. Worcester Renter-Occupied Homes



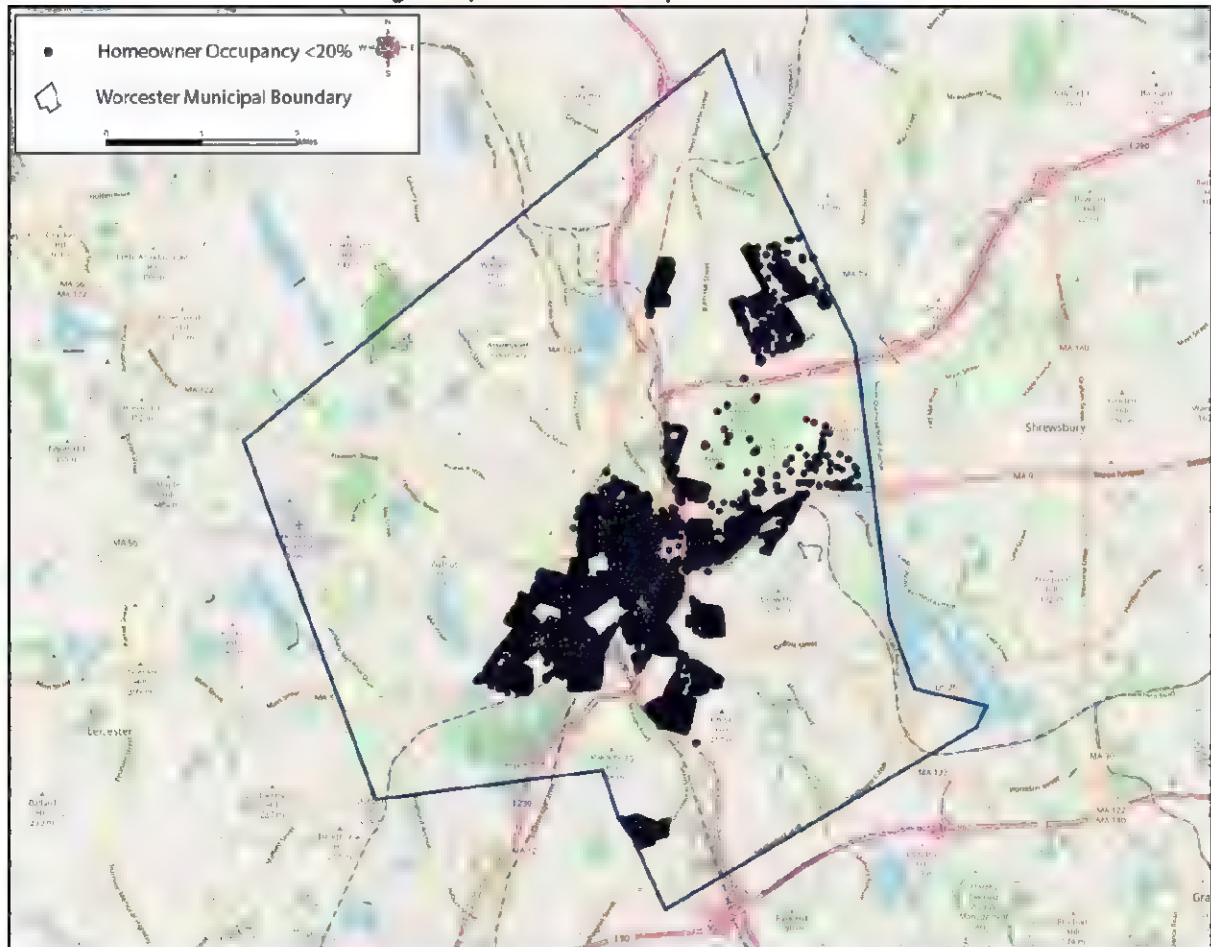
¹³ Environmental Systems Research Institute.

¹⁴ <https://censusreporter.org/profiles/16000US2582000-worcester-ma/>

The benefit of owner-occupied structures to home values and local fire departments is the care and maintenance performed on the “investment.” Citizens who are unable to maintain home heating, cooking, electrical, and mechanical systems use local government services, including fire and emergency medical services, at higher percentages than those who regularly upkeep and service these systems.

Another benefit of a stable local economy is the rate at which citizens remain in a household. In Worcester, 85.7% of citizens report living in the same household as in the previous year. This longevity provides for increased rates of investing in repairs and upgrades to make homes safer and more energy-efficient and assists in maintaining housing values. Worcester’s one-year rate is also lower than that of the state, where 87.3% of citizens report living in the same house one year prior. Worcester’s rate is slightly higher than the U.S. average of 85.5%. The next figure identifies locations where homeownership is less than 20%.

Figure 14. Homeownership Less than 20%



Homeownership in and around the downtown area is low, meaning that many residents rent the properties where they live. Compared to Figure 8, the locations of high incident density for the fire department and where low homeownership occurs are generally in the same locations.

At-Risk Populations

Several causal factors determine the population of at-risk individuals or groups within a community. Understanding the causal factors and populations of the community that are at greatest risk will contribute to programs and prevention efforts to address higher risk factors and reduce the effects of the associated risks. These factors also are important to consider when calculating demand for fire and emergency services within the community.

Often defined very broadly, the term “populations at risk” does not include all citizens within a defined group, as they experience risk at varying levels or rates. Coupling two or more risk factors contribute to significantly higher levels of risk than those who only experience one risk category. Those with compounded risk factors should be a priority in prevention programs and strategies.

Broadly, “populations at risk” includes citizens at the lower end of socioeconomic status, those with housing and transportation challenges, those of minority status or with English-speaking challenges, and households containing citizens with disabilities, and those over 65 and under 17 years of age. More specifically, citizens most at risk include the impoverished, disabled, homeless, racial, and ethnic minorities, as well as people with low literacy. Also, groups suffering from poor health or who are uninsured/underinsured may be at greater risk during emergency or disaster situations.

Figure 15. Vulnerability Factors Matrix



Understanding the age, gender, and historical geographic distribution patterns among fire victims is critical to developing appropriate community risk reduction strategies. Additionally, studies have shown that these same factors indicating populations at risk for death or disability from fire can also be good predictors of medical emergencies and diseases. These groups may require greater time, effort, and resources to prepare, evacuate, and recover from emergency situations. In addition to deciding where to focus risk reduction efforts within a community, Worcester Fire Department should carefully consider these factors when creating emergency plans for wide-area disasters within the community.

The following discussion includes several of the populations most at-risk within the Worcester Community.

Males

Males, especially those under 25-years of age, are more prone to engage in risky activities. Additionally, males are 1.7 times more likely to die in fires than females. Within Worcester, 49.1% of the population is male. The city's population distribution is unlike the state's population, where 51.5% of the population is male.

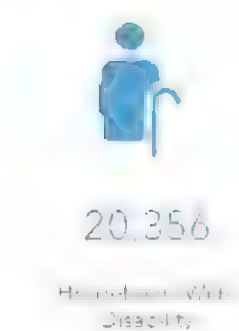
Age

Worcester's population over 65 years of age makes up 13.6% of the population. The percentage of residents reaching senior status in Worcester is slightly below the state average of 17% and the national average of 16.5%, respectively. Coupled with the senior population to make up those most at risk are the 5% who are under five years of age. These two age groups (18.6% combined) are statistically more reliant on the emergency services offered by the Worcester Fire Department. Understanding these types of data assists in developing targeted safety campaigns and hazard reduction efforts.

Disability

Fires in the home can be potentially dangerous and deadly for everyone, but persons with disabilities and impairments face additional challenges. Persons with disabilities often have a difficult time identifying or escaping a fire. There are 20,356 households that have identified as having one member with a disability.¹⁵ These citizens in the community would benefit from programs to assist in their needs during times of emergency and for emergency planning efforts.

¹⁵ Environmental Systems Research Institute.

Figure 16. Number of Households with a Disabled Person in Worcester**Language**

According to the National Fire Protection Association (NFPA), “Language barriers, cultural differences, and inexperience with unfamiliar home technologies are factors that mark the challenges of helping newcomers live safely from the threat of fire in the home.” By itself, speaking a language other than English at home does not directly contribute to a higher risk of emergencies; however, if a person has difficulty speaking English, it may contribute to negative outcomes during an emergency.

Most of the population within Worcester speak English, whether as a primary or a secondary language. In Worcester, 34.6% of the population purport to speak a primary language other than English. Often, organizations overcome language barriers through a diversified workforce, allowing these persons to receive proper care during emergency incidents. This suggests that normal English versions of fire safety messages are potentially missing a large cross-section of the community. Prevention and education messages could reach more residents if the messaging were expanded to include additional languages.

Income

Low-income residents typically utilize government services at higher rates than other economic brackets. Persons living in poverty experience an increased risk from fire and medical emergencies due to the age and condition of their housing, inability to pay for routine medical care, lack of medical insurance, and general health conditions. Often associated with poverty is the lack of reliable transportation, which likewise leads to increased demand for local emergency services. The income distribution in the City of Worcester is compared to the State of Massachusetts in the following figure.

Figure 17. Income Distribution of Worcester¹⁶

Households by Income		
The Largest Group: \$50,000–\$74,999 (17.4%)		
The Smallest Group: \$200,000 + (4.7%)		
Indicator	Value	Difference
< \$15,000	16.0%	+7.2%
\$15,000–\$24,999	12.1%	+3.7%
\$25,000–\$34,999	8.3%	+1.7%
\$35,000–\$49,999	13.2%	+2.6%
\$50,000–\$74,999	17.4%	+1%
\$75,000–\$99,999	11.0%	-1.5%
\$100,000–\$149,999	12.4%	-4.8%
\$150,000–\$199,999	4.8%	-4.8%
\$200,000+	4.7%	-5.3%

Those living below the poverty line are the most at-risk. Unfortunately, those at risk due to income often represent additional “at-risk” categories. Examples where the low-income category often combines with other factors include education, disability, and work status. Of the citizens living in Worcester, 20% live in poverty, well above the state’s average of 9.4%, and the national average of 11.8%. Contributing to the lower poverty rates are the education level and the employment rate in the city and county. Nevertheless, the impoverished should be the focus of many of the programs and services of the fire department. These citizens benefit at greater levels from fire and fall prevention programs, emergency planning activities, supply distribution programs, and from materials targeting the risks they face routinely.

Physical Hazards

While it is impossible to predict or prevent risks stemming from environmental events accurately, it is possible to identify these factors based on historical data and apply mitigation strategies to reduce the level of impact. Worcester Fire Department has several weather-related and environmental risks of concern. These include dam failure, drought, earthquakes, extreme temperatures, flooding, hurricanes, severe snowstorms/ice storms/nor’easters, severe thunderstorms/tornadoes/wind, and wildfires/brushfires.

The climate for Worcester is like that found across the Commonwealth of Massachusetts. Rainfall averages about 62.3 inches with higher-than-average precipitation in June through September. The annual average temperatures range from a high of 56 °F to a low of 39.6 °F, with the average temperature being 47.8 °F.

¹⁶ Environmental Systems Research Institute.

Dam Failure

According to the Massachusetts Office of Dam Safety, there are 25 dams in Worcester, 16 of which are owned by a government entity and nine by private owners. Six are High Hazard, and 12 are Significant Hazard. While Worcester has a fairly high number of High and Significant Hazard dams, there are no reported previous dam failure events in the 150-plus years that dams have been present. The probability for future failure events is, therefore, “very low,” with less than a 1% chance of a dam bursting in any given year.¹⁷

Drought

Most of Worcester is served by the Department of Public Works and Parks, processing 50 million Gallons Per Day. The plant utilizes a series of ten surface water reservoirs located in Leicester, Paxton, Rutland, Holden, and Princeton, holding over 7 billion gallons of water. Because of the nature of droughts, this type of hazard would likely impact the entire community, meaning the location of occurrence is “large” or over 50% of the city. In Worcester, the last drought event with substantial impacts occurred in 2016. As with all communities in normally precipitation-rich Massachusetts, Worcester is unlikely to be adversely affected by anything other than a major, extended drought. While such a drought would require water-saving measures to be implemented, foreseeable damage to structures or loss of life resulting from the hazard would likely be very limited, with a modestly increased risk of damaging forest or brush fires. Based on the above assessment, Worcester has a hazard index rating of “4 – low risk” from drought. Minimal or no loss of property or damage to people or property is expected due to this hazard.¹⁸

Earthquakes

One measure of earthquake activity is the Earthquake Index Value. It is calculated based on historical earthquake events data using USA.com algorithms. It is an indicator of the earthquake activity level in a region. A higher earthquake index value means a higher chance of earthquake events.

Based on the 2018 Worcester Hazard Mitigation Plan, the local Hazard Mitigation Team reported that no earthquakes had been felt in Worcester. Based upon existing records, there is a “very low” frequency (less than 1% probability in any given year) of an earthquake in Worcester.

Figure 18. Earthquake Index¹⁹

Earthquake Index for the City of Worcester	
City of Worcester	0.34
Massachusetts	0.70
United States	1.81

¹⁷ <http://www.cmrpc.org/worcester-hazard-mitigation-plan>

¹⁸ <http://www.cmrpc.org/worcester-hazard-mitigation-plan>

¹⁹ <http://www.usa.com/massachusetts-state-natural-disasters-extremes.htm#EarthquakeIndex>

Extreme Temperatures

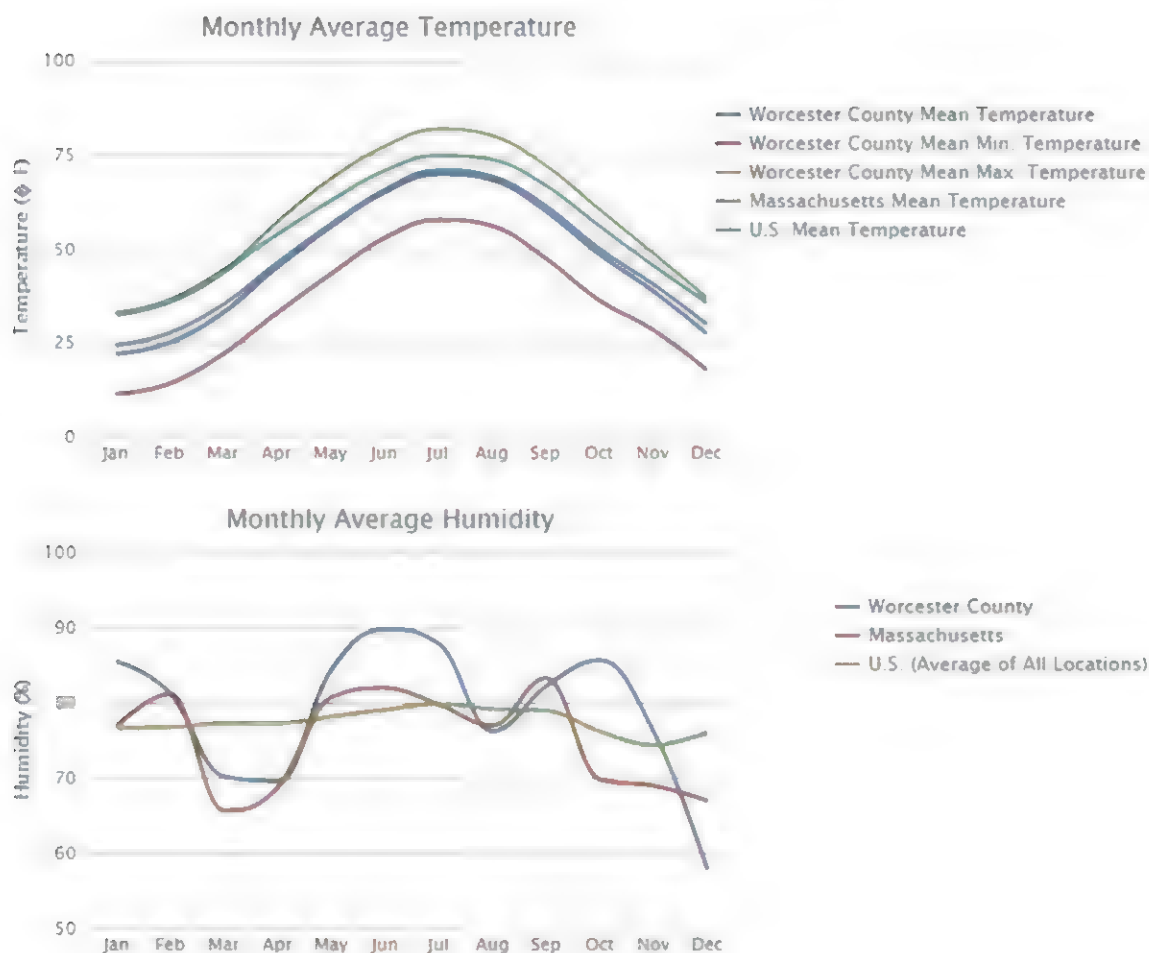
Extreme temperatures can be defined as those that are far outside the normal ranges. The average temperatures for Massachusetts are:

Winter (Dec–Feb) Average = 27.51 °F

Summer (Jun–Aug) Average = 68.15 °F

The impact of extreme heat or cold in Worcester is considered to be “limited,” with no property damage and very limited effect on humans. Extreme temperatures are of some concern for the local Hazard Mitigation Team due to health threats to the very young and very old and the homeless. Bursting pipes with extreme cold and air quality issues with extreme heat could impact emergency responders.

Figure 19. Temperature and Humidity in Worcester, MA²⁰



²⁰ <http://www.usa.com/worcester-county-ma-weather.htm>

Flooding

Flooding was the most prevalent natural hazard identified by local officials in Worcester. Flooding is generally caused by hurricanes, nor'easters, severe rainstorms, and thunderstorms. Residents living in flood zones should be informed of the risks. During the planning process, the City must consider station location and relocations in relation to flood zones. Flood zone and flood insurance information should be part of the public education process to ensure flood awareness and actions residents need to take to ensure readiness.

During a flood event, Worcester Fire Department personnel may respond to incidents that may involve moving water, possibly requiring intervention by specialty-trained technical rescue teams. In addition, after the flood, EMS-related incidents will increase as injuries and medical conditions occur. Figure 20 is a summary of flood zone risks.

Based on the Worcester Hazard Mitigation Plan's analysis: "Worcester faces a hazard index rating of '2—high risk' from flooding. Further vulnerability results from the location of certain critical infrastructure. The Webster Square Fire Station is located within the 100-year flood zone. Additionally, sections of evacuation routes, including Routes 9, 122A/146, and I-290, are located in or adjacent to areas prone to flooding. Other Critical Facilities include the Electrical Substation at Webster Square and the WRTA Administrative Building Headquarters. St. Vincent Hospital has flooded in recent years. A vulnerable population (elderly residents) residing in 256 units at the Webster Square Towers (East & West) is located in the flood plain. If evacuation routes and critical facilities such as those listed above are flooded, emergency response and/or evacuations could be hampered."²¹

²¹ <http://www.cmrpc.org/worcester-hazard-mitigation-plan>

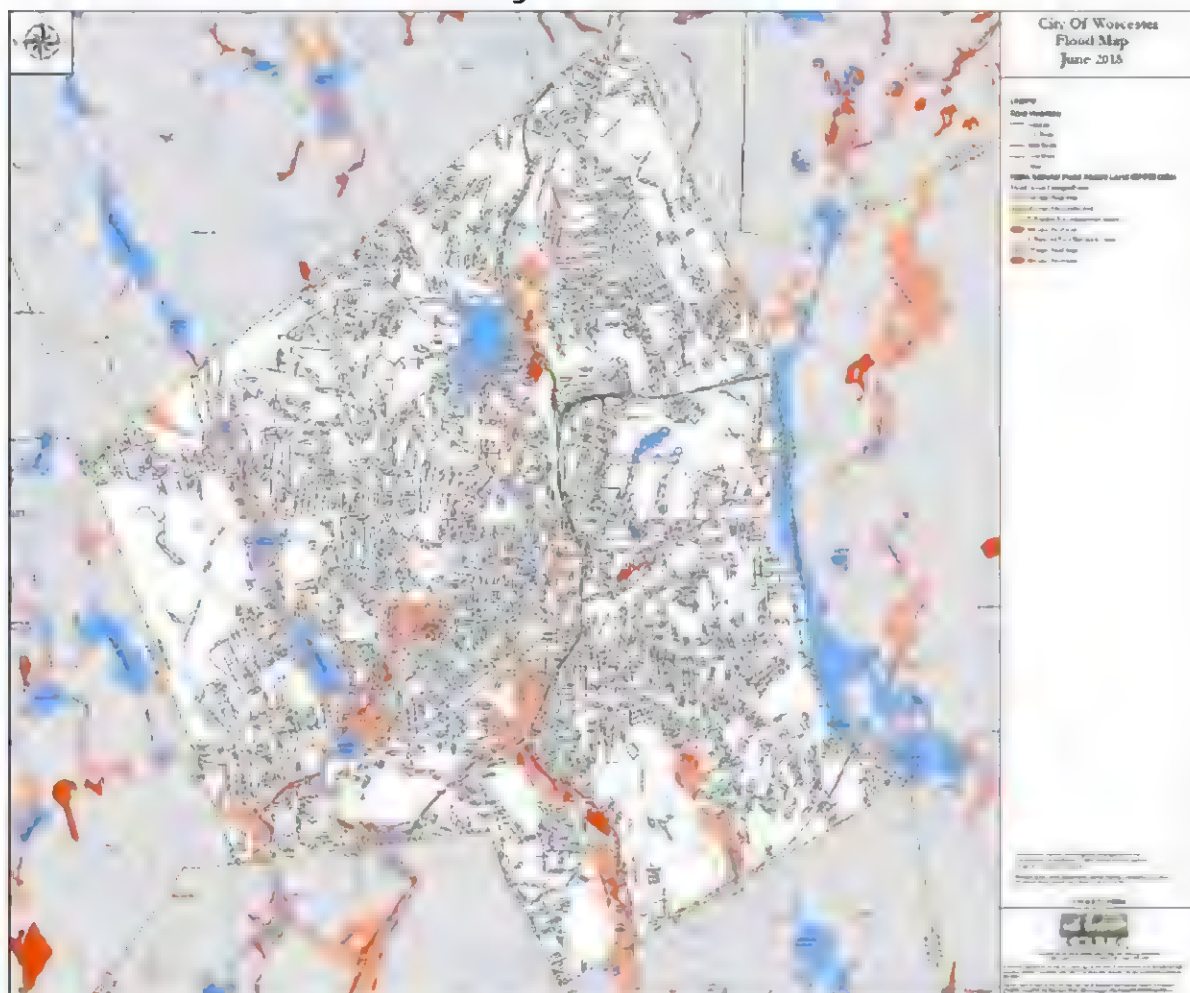
Figure 20. Summary of Flood Zone Risks

Zone	Risks ¹
A Zone AE Zone AO Zone	High Special Flood Hazard Area (SFHA) Flood-prone building codes apply Flood insurance is mandatory for most mortgage holders <ul style="list-style-type: none"> • A Zone: 100-year floodplain, with no Base Flood Elevations (BFEs) determined. • AE Zone: 100-year floodplain, with BFEs determined. • AO Zone: 100-year floodplain with sheet flow, with BFEs determined.
VE Zone, V1-V30	High Special Flood Hazard Area (SFHA). Flood-prone building codes apply. 100-year floodplain with wave action, no base flood elevation determined.

¹ FEMA updated flood zones; new version called DFIRM (<https://mapwide.com/maps/Massachusetts/hazards.php>).

Figure 21 illustrates the flood zones in WFD. With less than 10% of the total city area likely to be affected by a flood event, according to the effective flood maps, the City faces a potential “minor” impact.

Figure 21. Flood Zones



Hurricanes

Hurricanes are a high weather-related risk for WFD. Because of the hazard's regional nature, the entire City of Worcester is at risk from hurricanes, meaning the location of occurrence is "large." Ridgetops are more susceptible to wind damage, while areas susceptible to flooding are likely to be affected by heavy rainfall.²² Hurricanes that have affected the region in which Worcester is located through 2017 are shown in the following figure.

²² <http://www.cmrpc.org/worcester-hazard-mitigation-plan>

Figure 22. Major Hurricanes and Tropical Storms²³

Major Hurricanes and Tropical Storms Affecting the Region		
Storm Name	Year	Saffir/Simpson Category (When reached MA)
Great Hurricane of 1938	1938	3
Great Atlantic Hurricane	1944	1
Hurricane Dog	1950	Unclear
Carol	1954	3
Edna	1954	1
Diane & Connie	1955	Tropical Storms, 5 days apart
Donna	1960	Unclear, 1 or 2
Belle	1976	Minor Storm
Gloria	1985	1
Bob	1991	2
Floyd	1999	Tropical Storm
Irene	2011	Tropical Storm
Sandy	2012	Tropical Storm

Hurricanes are measured on a Saffir-Simpson Hurricane Wind Scale. Figure 23 illustrates the categories and typical damage associated with wind speeds.

²³ National Oceanic and Atmospheric Administration.

Figure 23. Saffir-Simpson Hurricane Wind Scale

Scale	Wind Estimate MPH	Typical Damage
Cat 1	74–95	Very dangerous winds will produce some damage: Well-constructed frame homes could have damage to roof shingles, vinyl siding, and gutters. Large branches of trees will snap, and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
Cat 2	96–110	Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power
Cat 3 (Major)	111–129	Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
Cat 4 (Major)	130–156	Catastrophic damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
Cat 5 (Major)	157 or Higher	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

² Retrieved from: <https://www.nhc.noaa.gov/aboutsshws.php>.

Hurricanes have many days of warning before the effects of the storm are encountered. The community and the fire department have time to prepare before the storm. Damage from a hurricane can be widespread and affect each area of the community differently (storm surge, wind, tornado, flooding, etc.).

First responders must have a planned response for hurricanes, including facilities that withstand the effects of winds and flooding and additional staffing to handle long operational working hours. First responders must be placed in protected areas during hurricane impact. After the storm, Worcester Fire Department resources must be available to begin rescue efforts.

Severe Snowstorms/Ice Storms/Nor'easter

The entire City of Worcester is susceptible to severe snowstorms, which means the location of occurrence is "large." Because these storms occur regionally, they would impact the entire City. The Worcester Regional Airport is especially vulnerable to severe snowstorms due to its high elevation. Based upon the availability of records for Worcester County, the likelihood that a severe snowstorm will affect Worcester is "very high" (greater than 70% in any given year). The City faces a "limited" impact or less than 10% of total property damaged from snowstorms. The weight from multiple snowfall events can test the load ratings of building roofs and potentially cause significant damage. Multiple freeze-thaw cycles can also create large amounts of ice and make for even heavier roof loads and lead to ice dams and both interior and exterior structural damage.²⁴

Figure 24. Snowfall



Severe Thunderstorms

As per the Massachusetts Hazard Mitigation Plan, the entire City is at risk of high winds, severe thunderstorms, and tornadoes. The plan identifies Worcester and its surrounding communities as having a moderate frequency of tornado occurrence within the Massachusetts context. However, the actual area affected by thunderstorms, wind, or tornadoes is "small," with less than 10% of the City generally affected.

Tornadoes

Tornadoes can create winds of over 300 mph, which will cause a significant threat to life and property. Tornado intensity is measured on the Enhanced Fujita Tornado Scale with an intensity range from EF-0 to EF-5. The Enhanced Fujita Scale or EF scale became operational on February 1, 2007 and is used to assign a "rating" based on estimated wind speeds and related damage. The EF Scale was revised from the original Fujita Scale, developed in 1971, to reflect tornado damage better. Figure 25 is a summary of the damage associated at the various levels.

²⁴ <http://www.cmrpc.org/worcester-hazard-mitigation-plan>

Figure 25. Tornado Intensity, Enhanced Fujita Scale

Designation	Wind Speed, mph	Typical Damage ²⁵
EF-0	65–85	Minor or no damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e., those that remain in open fields) are always rated EF-0.)
EF-1	86–110	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF-2	111–135	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off the ground.
EF-3	136–165	Severe damage. Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations are badly damaged.
EF-4	166–200	Devastating damage. Well-constructed and whole frame houses completely leveled; cars and other large objects thrown and small missiles generated.
EF-5	> 200	Extreme damage. Strong-framed, well-built houses leveled off foundations are swept away; steel-reinforced concrete structures are critically damaged; tall buildings collapse or have severe structural deformations; some cars, trucks, and train cars can be thrown approximately 1 mile (1.6 km).

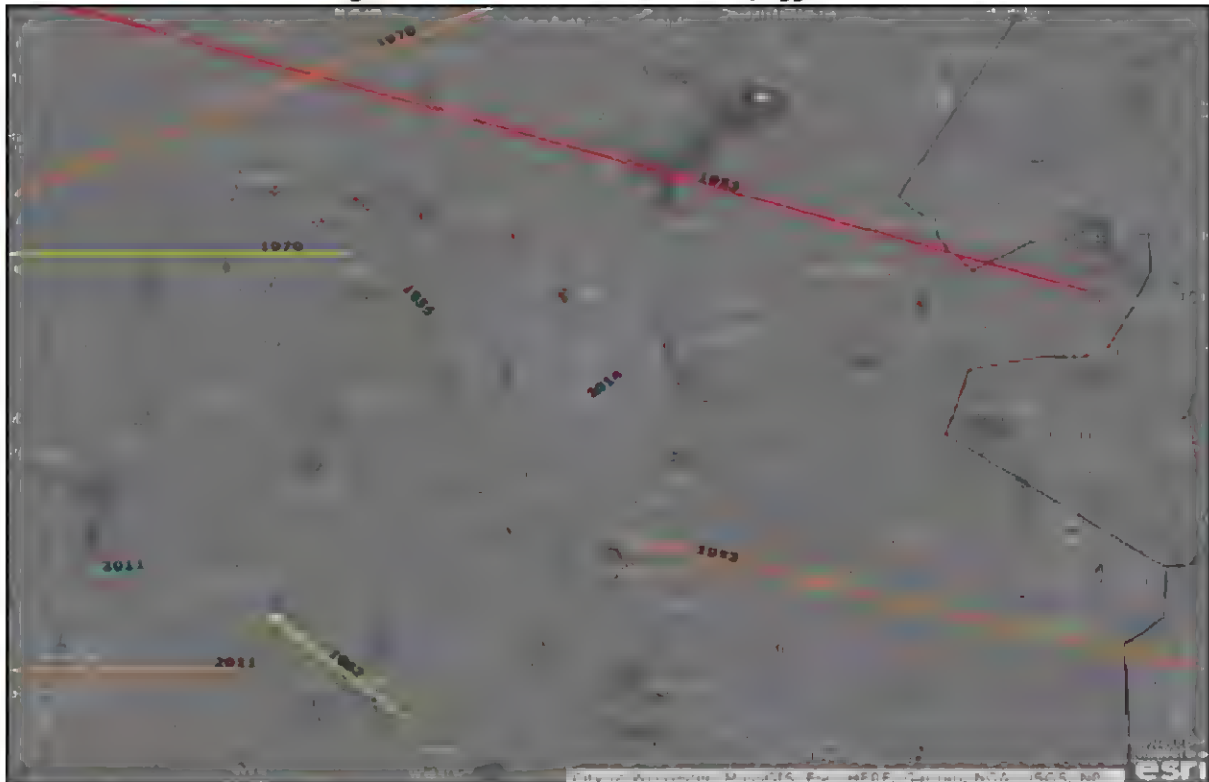
While ranges of winds are listed on the Enhanced Fujita Scale, the wind estimate is not exact or verified in science and engineering. Different wind speeds may cause similar damage from place to place and even from building to building.

Based upon the available historical record, as well as Worcester's location in a moderate-density cluster of tornado activity for Massachusetts, there is a "very low" probability (less than 1% chance in any given year) of a tornado affecting the City, and a moderate (10% to 40% chance in any given year) probability of a severe thunderstorm and/or high winds. Preventing a tornado is not possible, and one can occur with little or no warning. As the population increases, the potential danger to lives and property from tornadoes will also increase.²⁶ Figure 26 shows the paths of tornadoes in the past in or near the Worcester area between 1950 and 2016.

²⁵ https://en.wikipedia.org/wiki/Enhanced_Fujita_scale

²⁶ <http://www.cmrpc.org/worcester-hazard-mitigation-plan>

Figure 26. Worcester Tornado Tracks, 1950–2016



Wildfires

Wildland urban interface (WUI) fires describe an area where structures and other human improvements meet and intermingle with undeveloped wildland or vegetative fuels. Population growth substantially increases the risk of wildfire.

In Worcester, an estimated 21% of the land is forested. Worcester is developed in a mostly dense urban pattern, and few uninterrupted tracts of forest are present; the tree coverage does present some risk for wildfires and brush fires. The total amount of the City that could be affected by a wildfire is categorized as “small,” or less than 10% of the total area.

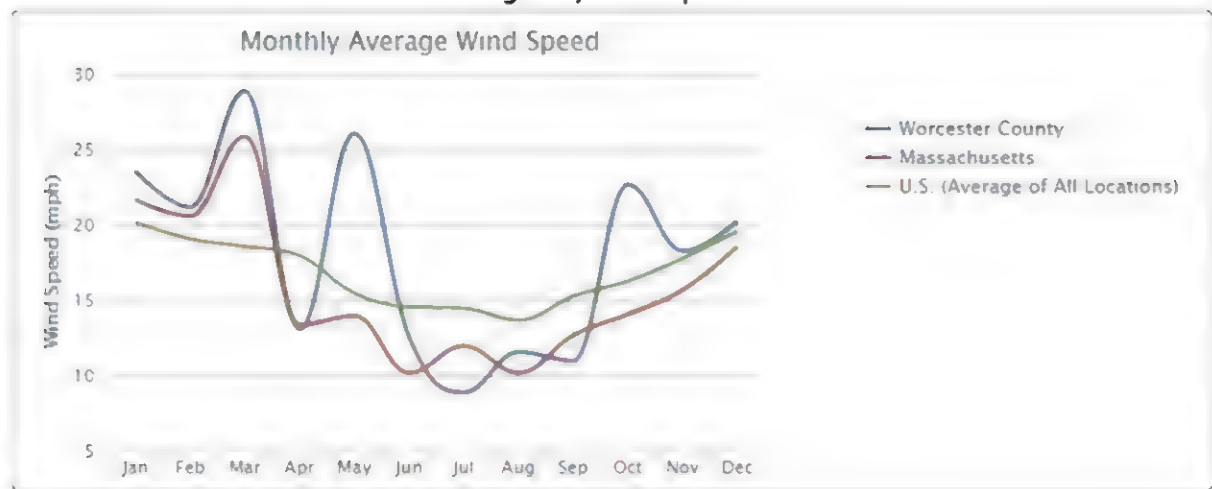
While approximately 21% of the City’s total land area is forested, and even though the risk is small, it does warrant consideration. This forested area is generally scattered throughout the community, with developed areas, rivers, and major transportation corridors (I-290, I-190, and Route 9) breaking up the forest. In drought conditions, a brushfire or wildfire would be a matter of concern. As noted in the next section describing previous occurrences of wildfire, there have not been any major wildfires recorded in Worcester in recent decades. Based on historical data for 2006–2015, it is estimated that a brush fire might destroy 499 acres of forested area (Massachusetts Fire Incident Reporting System).

While a large wildfire could, in theory, damage much of the landmass of Worcester, most forested areas are sparsely developed, meaning that wildfire-affected areas are not likely to cause damage to personal property. For this reason, the City faces a “minor” impact from wildfires, with little damage likely to occur. Based on the above assessment, Worcester has a hazard risk index of “4 – low risk” from wildfires.

Winds

Evidence shows that severe weather, including thunderstorms, damaging winds, and tornadoes, is already increasing as temperatures rise. The Massachusetts Multi-Hazard Mitigation Plan notes that smaller storm events are becoming less frequent, while more severe storms are becoming more common. Overall, the risk from severe storms, including related effects such as flooding, etc., can be expected to increase over time. The following figure shows the monthly average wind speed:

Figure 27. Wind Speed



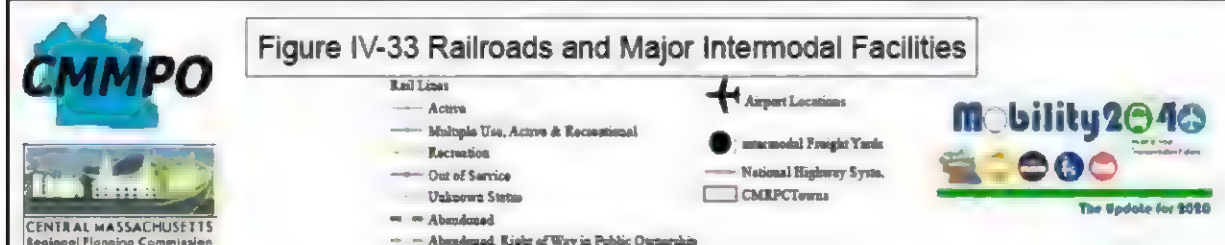
Technological (Human-Caused) Hazards

Transportation

There are several transportation corridors and various modes of transportation within the area of the Worcester Fire Department. Roadways have the potential for motor vehicle crashes, vehicle fires, medical emergencies, brush fires, or hazardous material spills/leaks. Each incident is not only a risk to the community but to the first responders who can potentially be struck by vehicles while operating near moving traffic.

Major roadways, railroads, and intermodal facilities in the region that serve the City of Worcester are shown in Figure 28. Regardless of the type of facility or transportation infrastructure, each poses a risk associated with human error.

Figure 28. Major Roadways, Railroads, and Intermodal Facilities



Land Use

Community Land Use Regulations

Future infrastructure requirements to sustain the growth of the Worcester Fire Department will be critical to property owners and coincides with zoning, subdivision regulations, and higher property values. Infrastructure will include roads and bridges, sewers, water, and fire hydrants. Worcester Fire Department should consider other infrastructure, including additional police and fire stations, hospitals, schools, and libraries. Additional considerations when examining the zoning of a jurisdiction are the impact new development and changes to the existing structures may have on emergency response capabilities.

Occupancy Types by Land Use Designation

Activities occurring within a building or on an undeveloped property can often be used to begin the process of risk classification. Zoning maps provide permitted use information for each parcel identified by land use designation. Vacant lots and open land are often identified as a much lower risk than commercial or industrial occupancies as open areas lack the people and processes associated with emergency incidents. Fires in commercial occupancies often lead to higher dollar loss than many residential properties, and the long-term income loss affects the people employed by the business when it is destroyed. In Worcester, while commercial fires can still have a dramatic impact on the community, residential fires in triple-decker buildings can have a much greater impact than ordinary residential fires. This is because these buildings often house as many as two dozen people, and a fire immediately displaces them. Since many are low income to begin with, following a fire, these displaced people may potentially become homeless and have no ability to protect themselves from the elements, particularly in the winter.

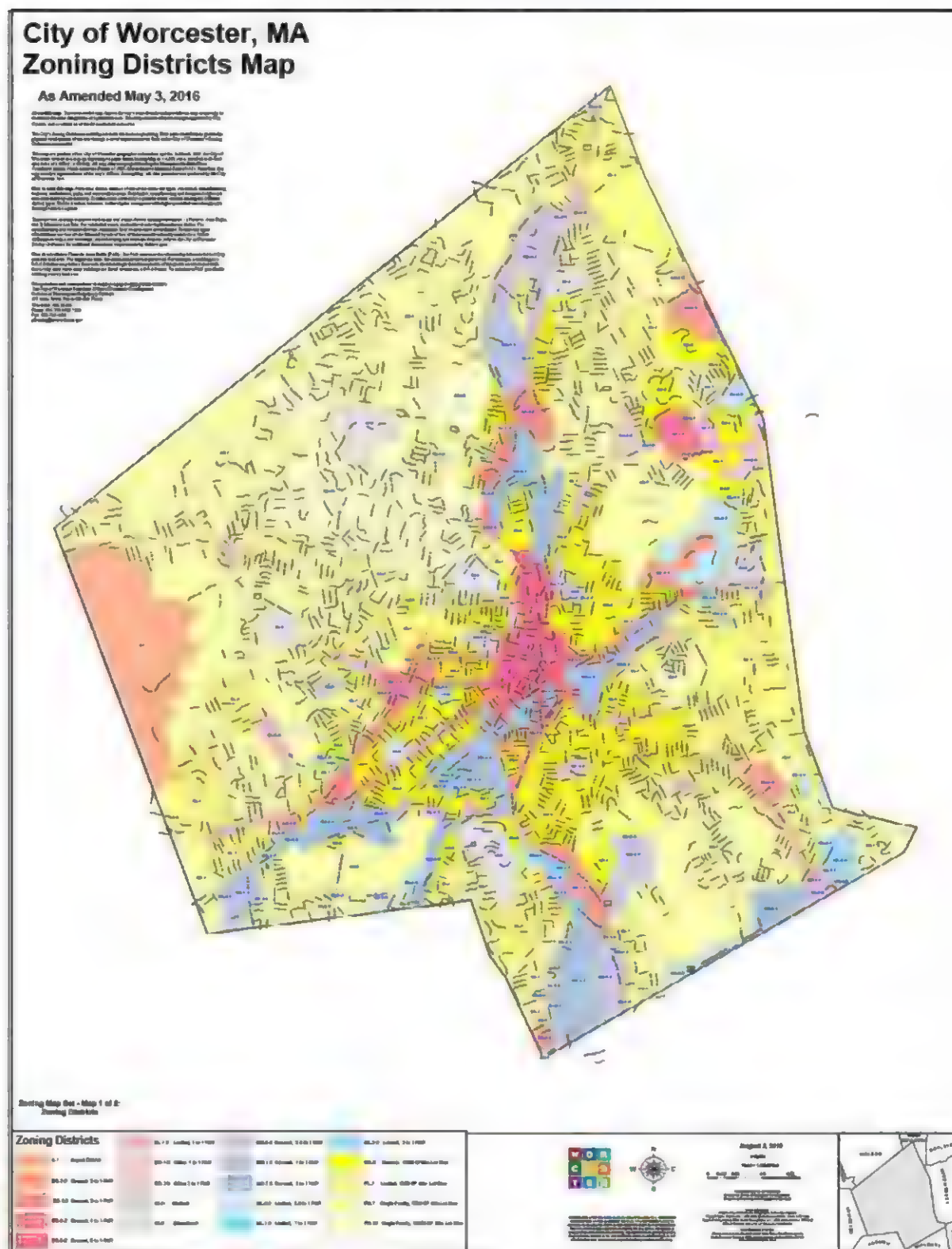
The following figure translates zoning to categories of relative fire and life risk.

Figure 29. Relative Fire and Life Risk

Relative Risk Category	Zoning
Low Risk	Areas zoned and used for agricultural purposes, open space, and very-low-density residential use.
Moderate Risk	Areas zoned for medium-density single-family properties, small commercial and office uses, low-intensity retail sales, and equivalently sized business activities.
High Risk	Areas zoned for higher-intensity business districts, mixed-use areas, high-density residential, industrial, warehousing, and large mercantile centers.

The following figure provides a simplified illustration of the general classes of zoning found in the City of Worcester. Categories are divided into commercial, industrial, residential, government, and open land/agriculture occupancies.

Figure 30. Zoning Classifications



Triple-Decker Homes

A defining characteristic of the Worcester landscape is the “triple-decker home.” When they were originally built, most of Worcester’s triple-decker homes were owner-occupied, allowing for income from the other rented floors. In recent years, the trend has been for fewer of the triple-decker homes to be owner-occupied.

Triple-decker homes made up half of all building construction between 1890 and 1900 in Worcester.²⁷ The City of Worcester reports that of the approximately 6,000 triple-decker homes that were built, that 4,914 remain in 2021. Even the youngest of these triple-decker homes, the ones built around 1920, are more than 100 years old.

Because of the age of these triple-decker homes, many of them have lead paint and other severe code violations. Inefficient boilers, roofs, and windows, and a single heating source such as a parlor stove or gas stoves that do not adequately heat the apartments, thereby causing high utility bills, are also common.

The triple-decker homes were built with a “balloon frame” construction. Balloon framing is a style of wood-house building that uses long, vertical 2" x 4" for the exterior walls. These long “studs” extend uninterrupted, from the sill on top of the foundation, all the way up to the roof. If those houses were to be built today, the code would require fire-blocking at each level and fire-rated sheetrock between each floor to stop a fire from traveling in the walls from the first floor all the way to the attic.

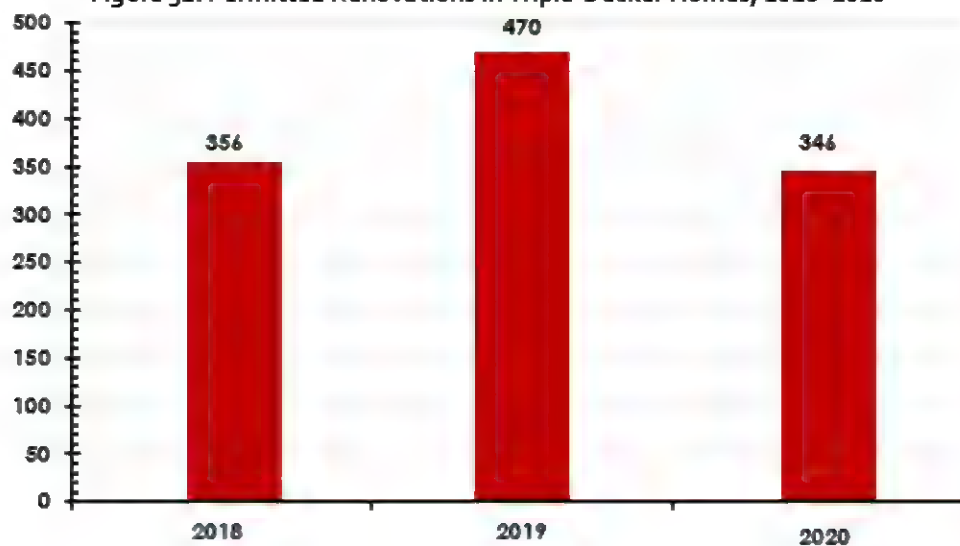
A review of the permitted renovations in triple-decker homes between 2018 and 2020 showed that between 346 and 470 renovations were permitted during each of the last three years.

Figure 31: Example Worcester Triple-Decker



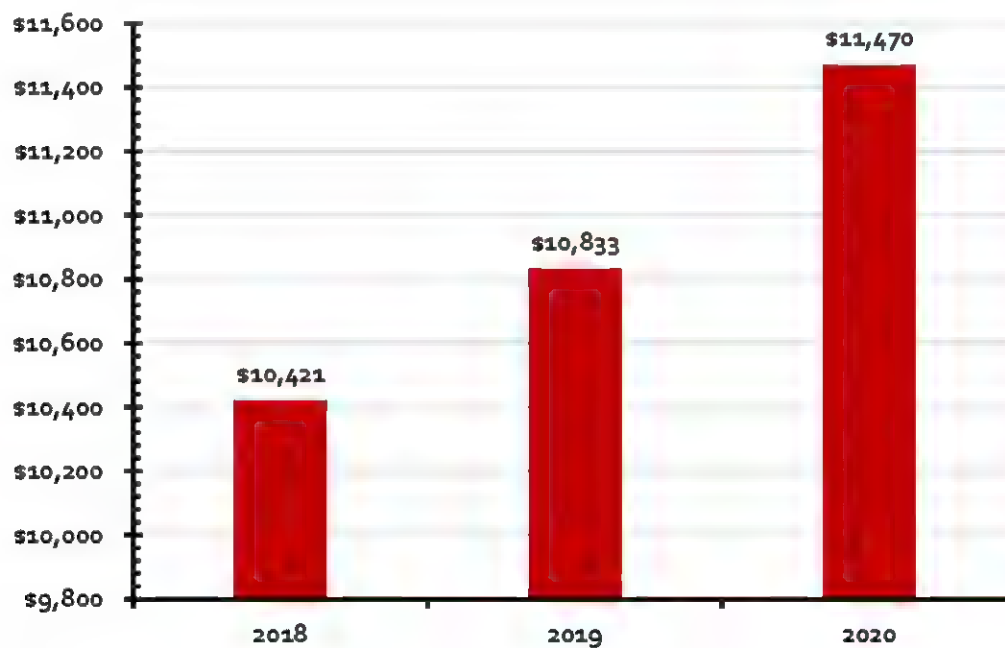
²⁷ www.newenglandhistoricalsociety.com/rise-fall-rebirth-new-england-triple-decker/

Figure 32. Permitted Renovations in Triple-Decker Homes, 2018–2020

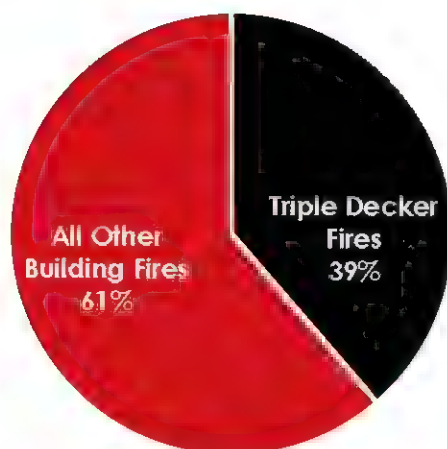


The median value of these renovations has increased from \$10,421 to \$11,470 during the last three years.

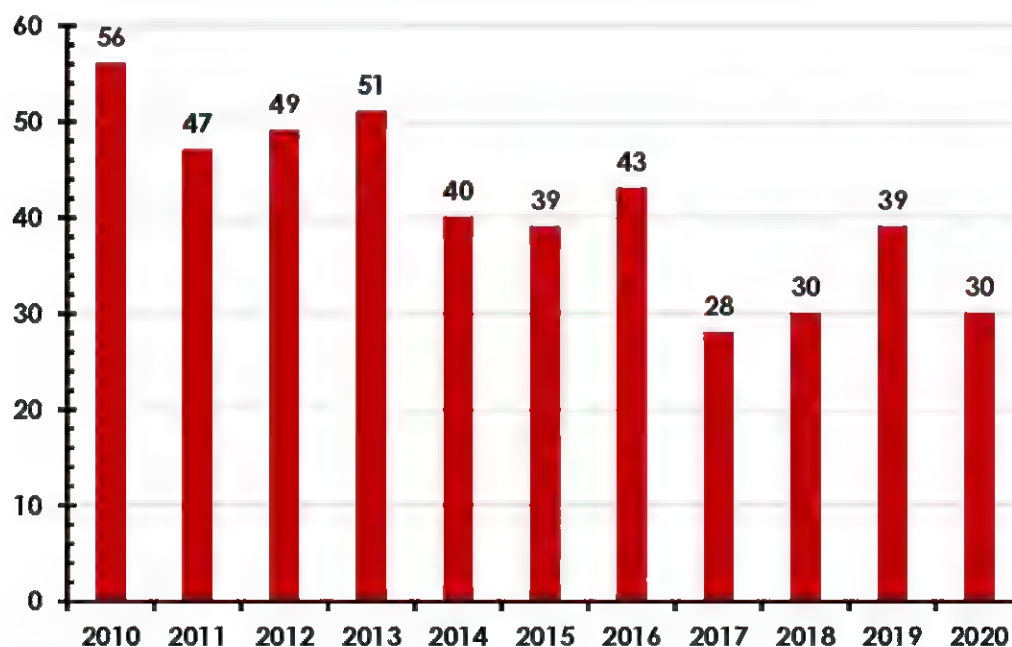
Figure 33. Triple-Decker Home Median Renovation Value, 2018–2020



Between 2010 and 2020, there were 1,169 building fires within the City of Worcester. Thirty-nine percent of these fires (452) occurred within triple-decker homes, and the remaining 61% (717 fires) occurred in other types of buildings.

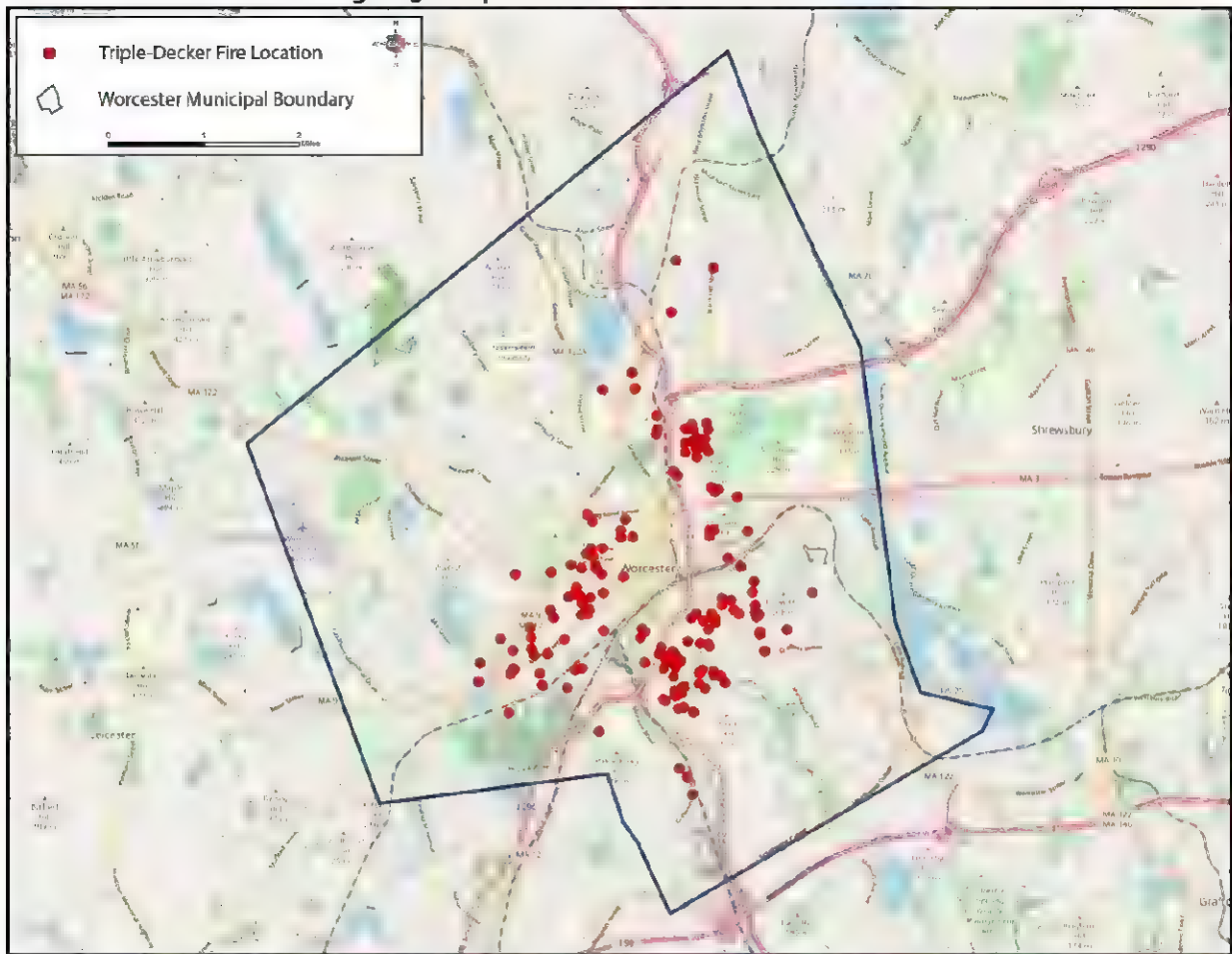
Figure 34. Comparison of Fires in Triple-Decker Homes and All Other Structures, 2010–2020

A review of fires in Worcester triple-decker homes during the last ten years showed that during the first half of the decade, there were between 39 and 56 fires per year; this number has decreased during the second half of the decade to between 28 and 39 fires.

Figure 35. Fires in Triple-Decker Homes, 2010–2020

Using Worcester's RMS data, the locations of fires in triple-decker homes from 2010 to the present were identified. Using GIS software, these locations were paired with their corresponding parcel layers, and the demographics of these parcels reviewed for trends in the data.

Figure 36. Triple-Decker Fire Locations Since 2010



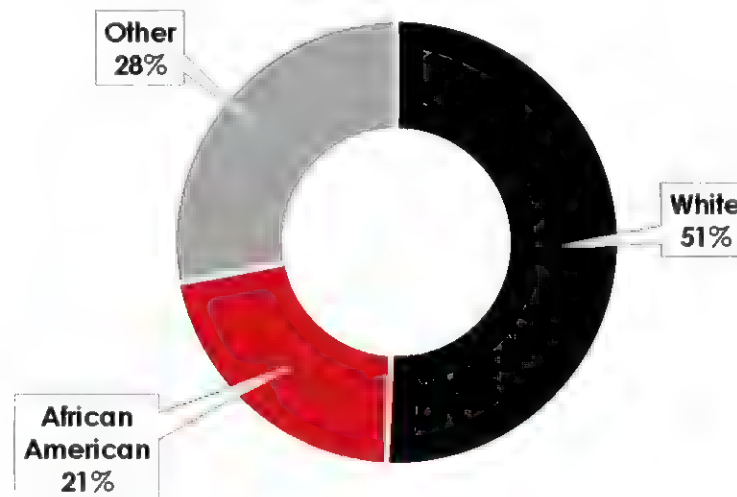
When the incident locations were matched to the parcels and available demographics queried via Esri's Living Atlas, the most noticeable data trend was the lack of data. Of the hundreds of parcels, only a handful of demographic data was available, suggesting that census information may not have been submitted for these properties. Additionally, for the identified parcels, 44% of building owners do not live in Worcester. This may be a leading cause for the lack of data for these buildings. In any case, knowing that the typical means for identifying at-risk populations who reside in these types of buildings will not be effective, Worcester Fire Department should investigate other methods to collect data for these buildings. Of the available data, the following trends emerged:

- 58.5% were born between 1981 and 2016, and 31.9% were born between 1946 and 1980
- 30.5 Median Age
- \$32,808 Median Household Income
- 32.3% are on food stamps
- 78.7% are renter-occupied

- 79.3% were built before 1939
- 15.7% were vacant housing units
- 35.3% have at least one person with a disability
- 22.9% carry health insurance
- 22.5% live below the poverty level
- 45.4% have completed high school or a higher level of education

Figure 37 provides a demographic breakdown.

Figure 37. Demographics of Triple-Decker Fires Since 2010



Three Worcester firefighters have died while fighting fires in the triple-decker homes since 2011. The *Risk Prioritization* section of this report offers a variety of methods to classify risk. While triple-decker homes are not classified as high-risk occupancies by any of these methods, due to the nature of some triple-deckers being converted into unpermitted boarding houses, as well as operational issues within the fire department, they present an inherent risk to life safety in Worcester for both residents and firefighters.

Physical Assets Protected

Data in the following section is referenced from Worcester Hazard Mitigation Plan (last revision date March 8, 2019).

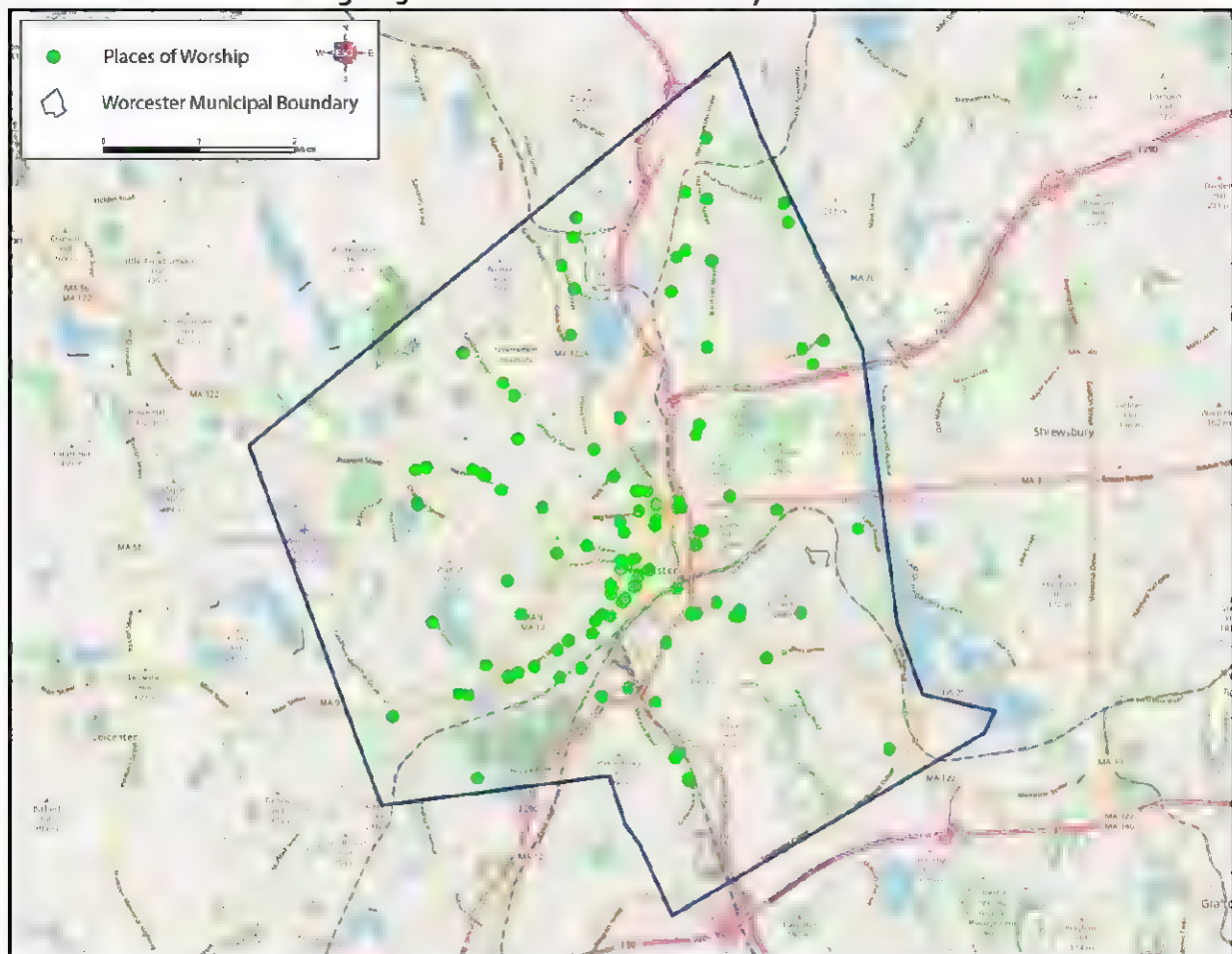
Public Assembly

An assembly occupancy is defined by the National Fire Protection Association (NFPA) as an occupancy used for gathering 50 or more persons for deliberation, worship, entertainment, eating, drinking, amusement, awaiting transportation, or similar uses or used as a special amusement building, regardless of occupant load.²⁸

According to the NFPA, fires in assembly occupancies have shown to be deadly when the proper features, systems, and construction materials were not present. The Worcester Fire Department can reduce life safety and fire risk to these properties through NFPA code provisions requiring a combination of multiple safeguards and features. Basic requirements include control of unintentional ignition sources, furnishings, and contents, as well as requiring fire alarm and sprinkler systems and the proper number of exits for the occupancy load calculated by the Worcester Fire Department. Figure 38 shows the number of churches located in the area.

²⁸ *Fire Safety in Assembly Occupancies*, October 2014. Retrieved from: <https://www.nfpa.org/Public-Education/Staying-safe/Safety-in-living-and-entertainment-spaces/Nightclubs-assembly-occupancies/Fire-safety-in-assembly-occupancies>.

Figure 38. Churches Located in the City of Worcester



Childcare Facilities

There are 230 childcare facilities operating within the City limits identified in the Worcester Hazard Mitigation Plan. These do not include public and private educational institutions.

Schools

The NFPA states that a facility where six or more people up to grade 12 receive instruction for four or more hours a day is considered an educational occupancy. Massachusetts educational facilities are subject to the NFPA Fire (NFPA 1) and Life Safety Codes (NFPA 101) through Massachusetts statutes and required to formulate policies and procedures for emergency drills and actual emergencies concerning fires, natural disasters, active shooter and hostage situations, and bomb threats. In addition, an emergency action plans must be developed for each facility, according to NFPA 1, to include fire and security safety. There are 86 public and private educational institutions within the City of Worcester. Worcester Fire Department provides effective prevention and safety programs during the school year to reduce risk factors through education. In addition to K-12 schools, Worcester is also home to nine colleges and universities. The populations of these schools are not included in census totals, unless the students permanently reside in Worcester off campus, and contribute to the City's daily population. Additionally, as schools develop and expand their need for tasks, such as plan reviews and inspections, they can at times tax the limited staffing available in the Fire Prevention Division.

Figure 39 shows an overview of several of the educational occupancies in Worcester.

Figure 39. K-12 Educational Occupancies

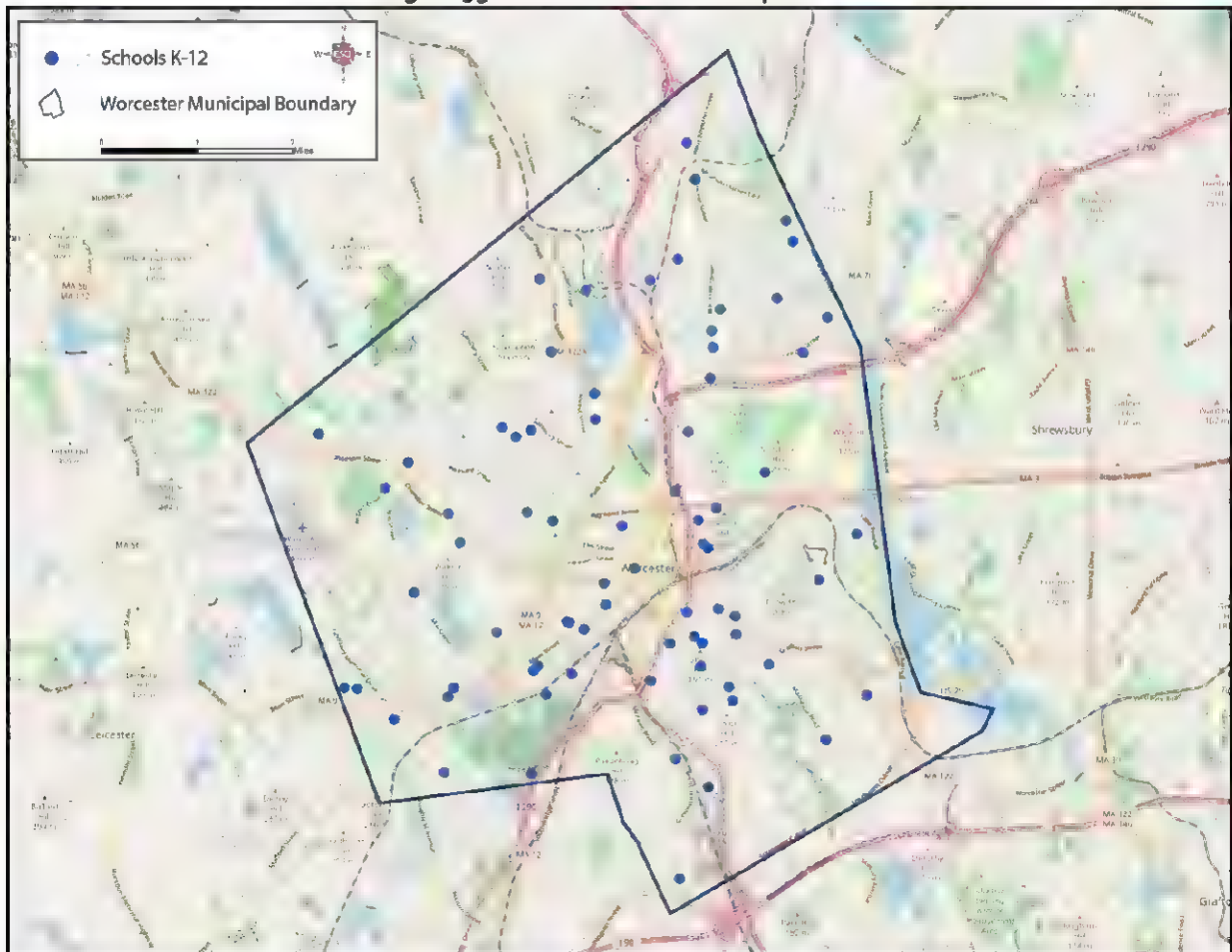
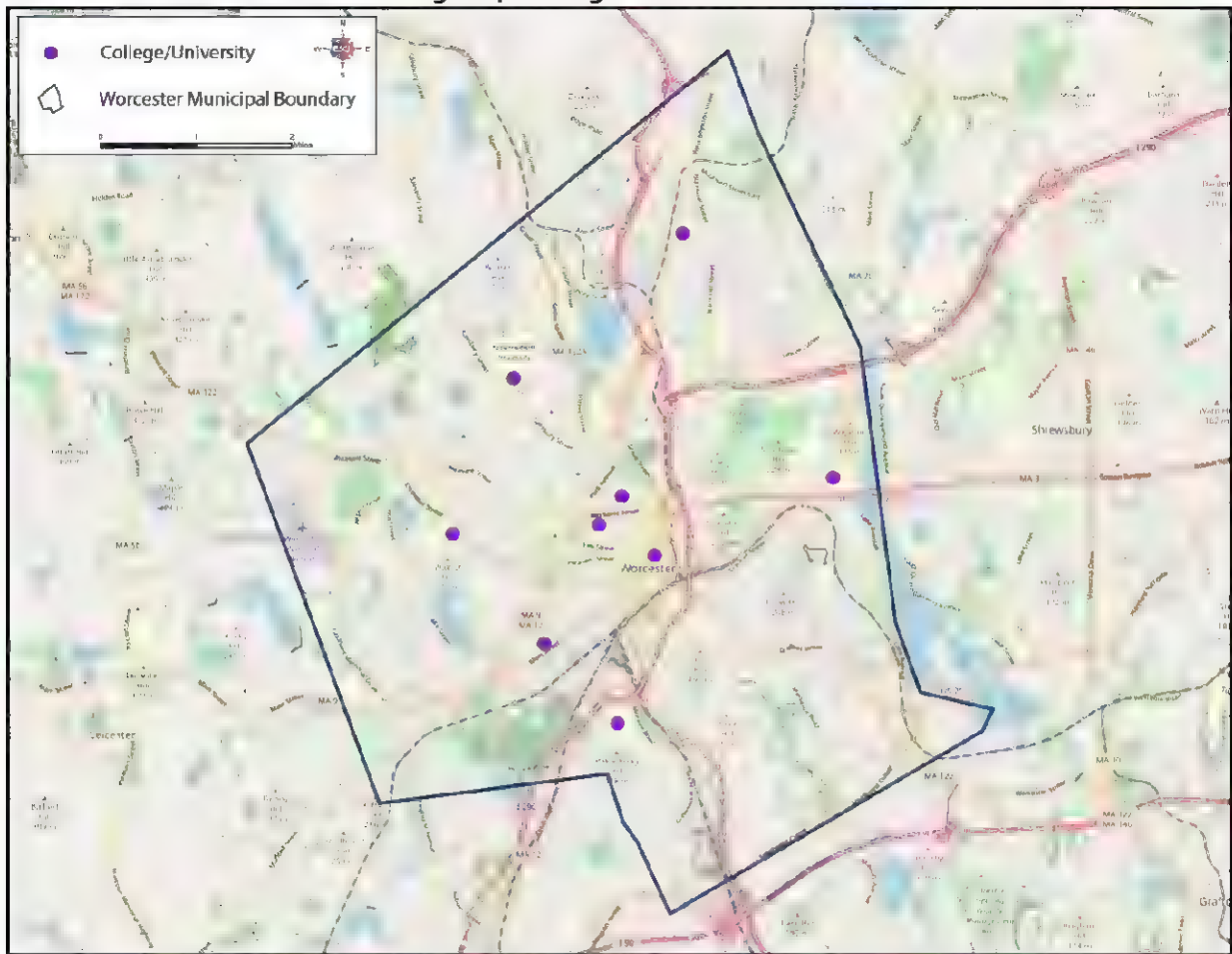


Figure 40. Colleges and Universities

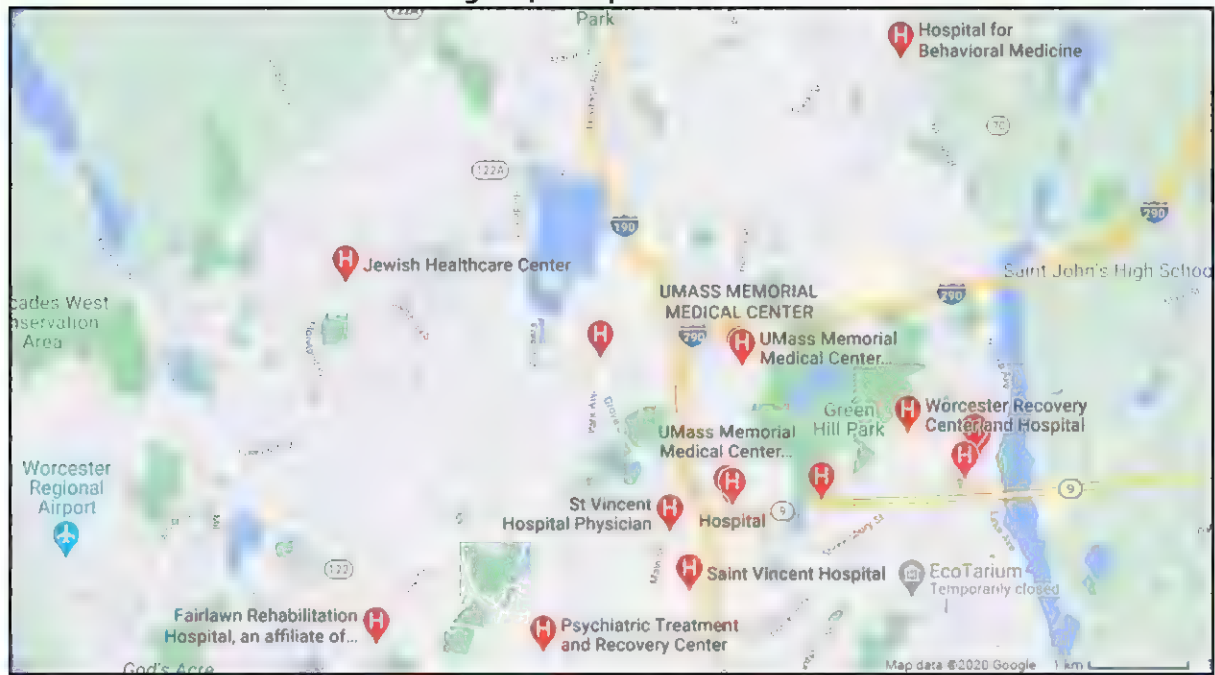


Hospitals and Medical Care Facilities

Medical and congregate-care facilities, particularly hospitals and nursing homes, provide care for and house vulnerable, often non-ambulatory occupants. Although these facilities have fire safety inspections and are generally built of fire-resistive construction with built-in fire suppression, emergencies still occur that require occupants to be quickly moved away from the hazard. These types of facilities require high resource levels, often for long periods, and will strain fire department capabilities.

Currently, 51 assisted living and skilled nursing care centers operate in the Worcester area. Evacuation plans for hurricanes are in place according to Massachusetts State Regulations; however, evacuations will take longer as the population increases in the area. EMS service capabilities will need to consider department benchmark performance impacts during evacuations and peak time periods, as population growth may increase call volume.

There are four large hospitals within Worcester along with several recovery, mental health, and urgent care facilities. Figure 41 shows the locations of the hospitals located in the city.

Figure 41. Hospital Locations

Critical Infrastructure

Communications

Emergency communication centers and the associated transmitting and receiving equipment are essential facilities for emergency response. The Regional Emergency Communication and Emergency Operations Center in Worcester houses the 911 Regional Emergency Communications Center, Worcester's Emergency Operations Center, 911 training facility, and all administrative offices for the city's Emergency Communications Department and Emergency Management Division staff. The center also serves the Town of Leicester for public safety 911 dispatch services and complements the city's emergency radio system. Worcester Fire Station 15, located at 80 McKeon Road, serves as the secondary PSAP for the city, while the training facility at Fire Station 3, located at 141 Grove Street, serves as the backup Emergency Operations Center (EOC).

The facility creates multiple system redundancies and allows space for future expansion in response to the state's requirement that the city's 911 center accepts all wireless 911 calls directly. This piece of emergency infrastructure helps ensure Worcester's police, fire, and other emergency responders and public works personnel have the best tools possible to keep residents safe.

There are other communication facilities and equipment that are equally important to the community and government operations within the Worcester Fire Department service area. These are the telephone company central offices and the transmission lines of local telephone service providers. Internet service providers, along with wireless cellular communication providers, provide essential communication capabilities for the community as well as emergency personnel through their facilities and equipment.

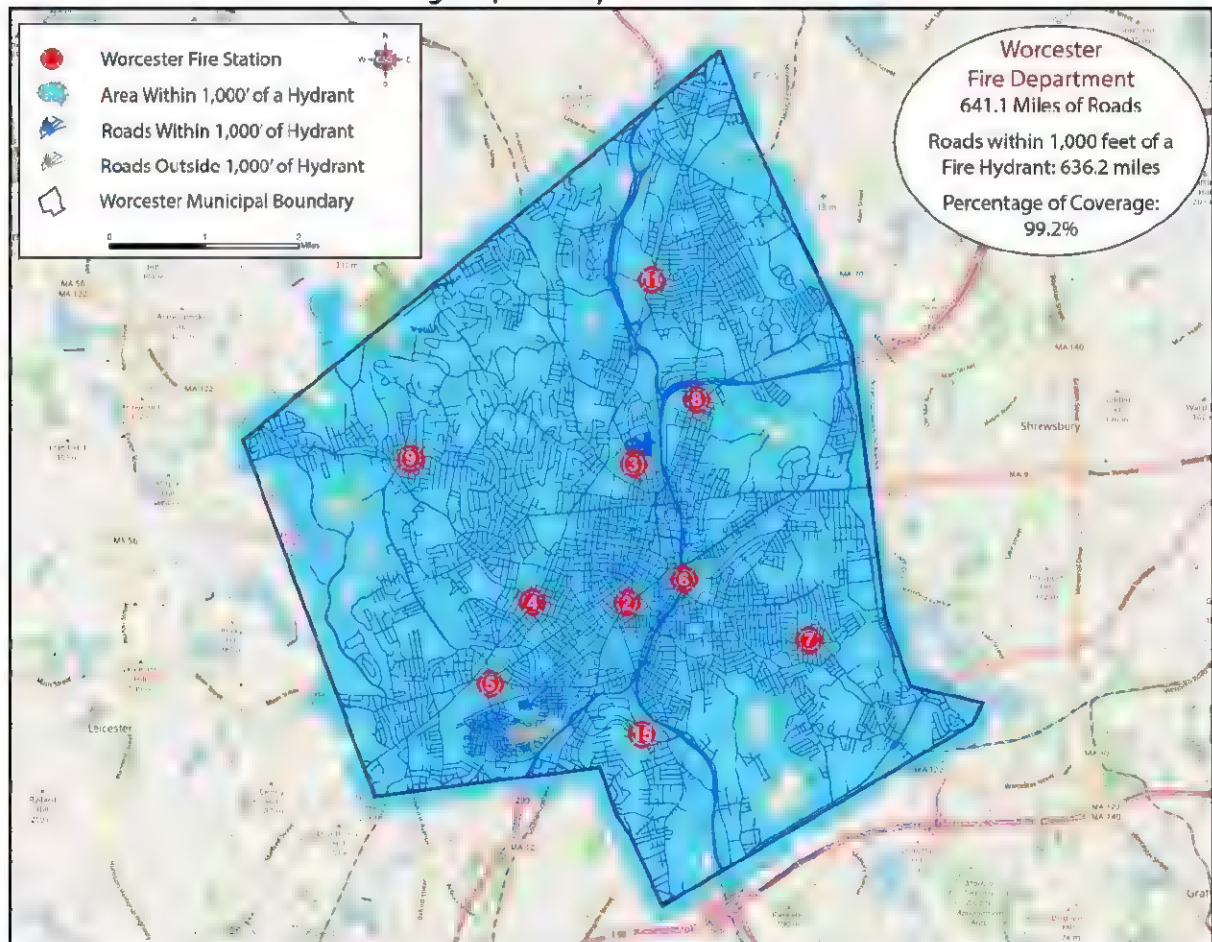
Energy

Without a stable energy supply, the health and welfare of the Worcester community are threatened, and the economy cannot function. Energy is uniquely critical to the community because it is an “enabling function” across all critical infrastructure in Worcester. Communication services can be greatly compromised during a power outage, rendering technology-based equipment and communications inoperable. Energy loss is a planning consideration for response and readiness requiring system redundancy development to reduce risk.

Water Distribution

Figure 42 shows the fire hydrant system in the City of Worcester and hence the water supply system. Critical to fire suppression operations, a failure of the water system is a risk of which the Worcester Fire Department must be aware.

Figure 42. Fire Hydrant Distribution



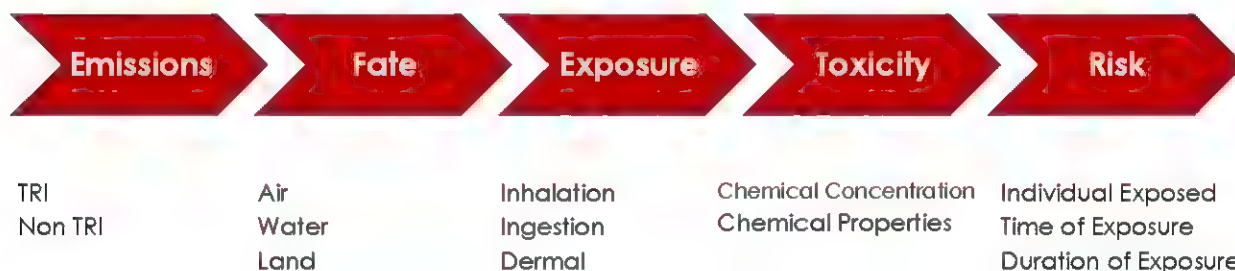
Hazardous Materials

Industries and businesses in Worcester use chemicals to make products such as pharmaceuticals, computers, paints, clothing, and automobiles. The majority of chemicals are included on the Toxics Release Inventory (TRI) chemical list managed by industrial facilities to minimize releases into the environment; however, releases still occur as part of business operations. It is the right of citizens to know what TRI chemicals are being used in Worcester as well as the management of the amounts released into the environment, and whether such quantities are increasing or decreasing over time. Under the Emergency Planning and Community Right-to-Know Act (EPCRA), facilities must report to EPA details about their releases of TRI-listed chemicals.²⁹

As of 1986, businesses that possess or maintain hazardous chemicals that exceed thresholds established by the Emergency Planning Community Right-to-Know Act are required to complete a Tier II Hazardous Chemical Inventory Report. These occupancies are required by the Environmental Protection Agency to annually submit Tier II reports to local fire departments, Local Emergency Planning Committees (LEPC), and State Emergency Response Commissions (SERC) so that these agencies can plan for the response and mitigation of any potential spills or accidents. Additionally, the reporting facility's designated emergency point of contact is also required as part of the submission.

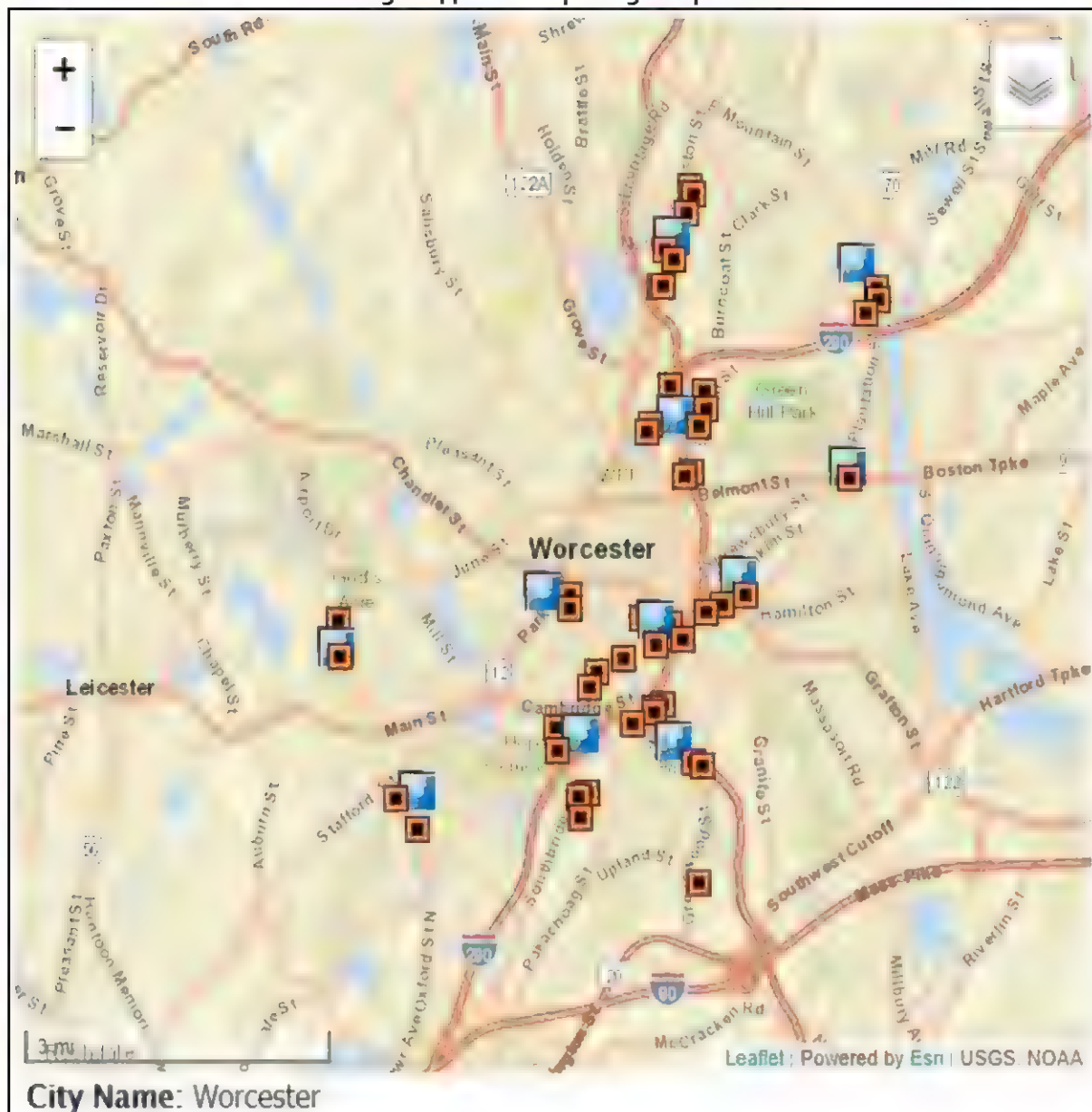
Figure 43 shows the many factors that determine the human health risks resulting from exposure to chemicals.

Figure 43. Overview of Factors that Influence Risk



¹Adapted from https://www.epa.gov/sites/production/files/2018-01/documents/tri_national_analysis_2016_complete_0.pdf.

²⁹ Introduction to the 2016 TRI National Analysis. Retrieved from: https://www.epa.gov/sites/production/files/2018-01/documents/introduction_tri_na_2016.pdf.

Figure 44. Tier II Reporting Companies³⁰

³⁰ https://ofmpub.epa.gov/frs_public2

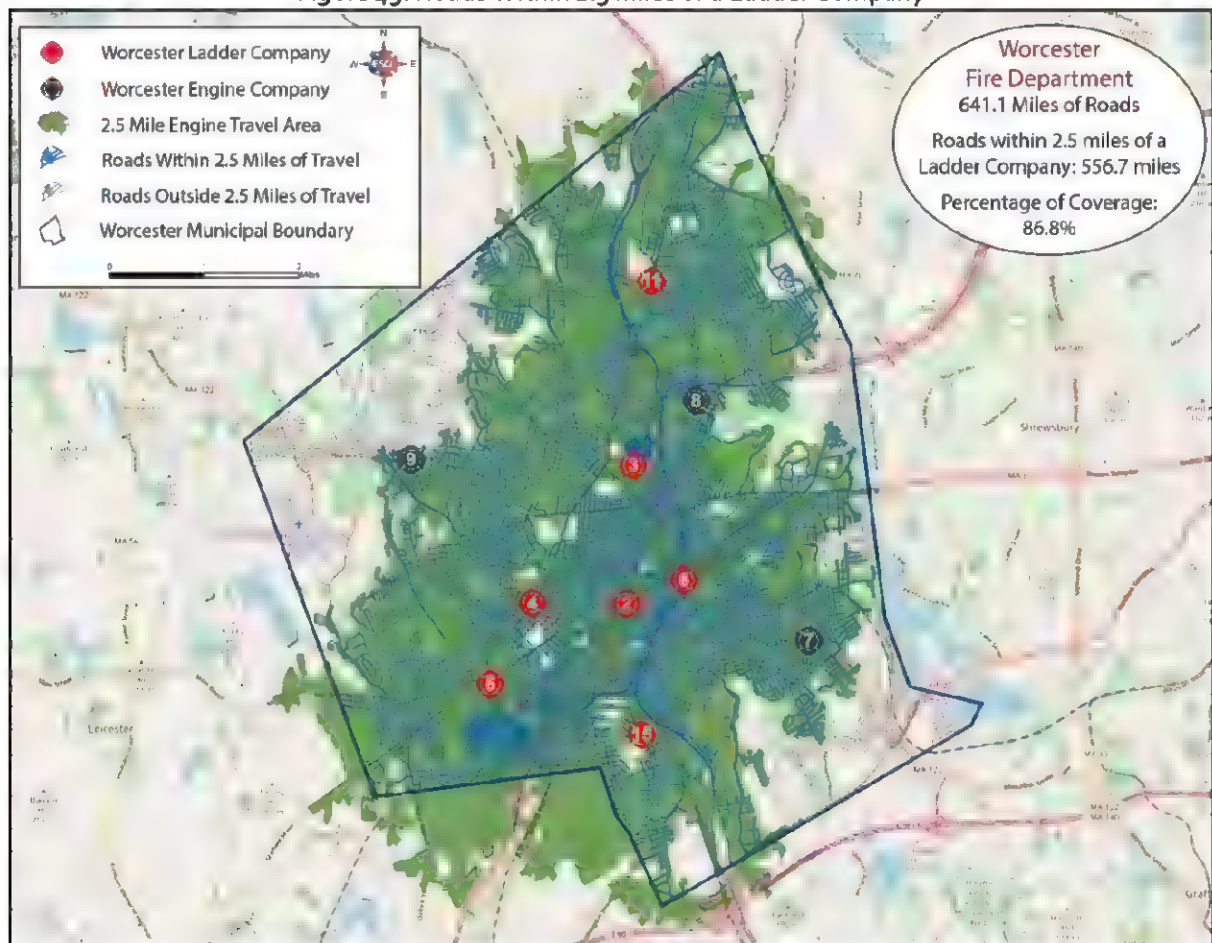
Structural Risks

Certain buildings, contents, functions, and sizes present greater firefighting challenges and require special equipment, operations, and training.

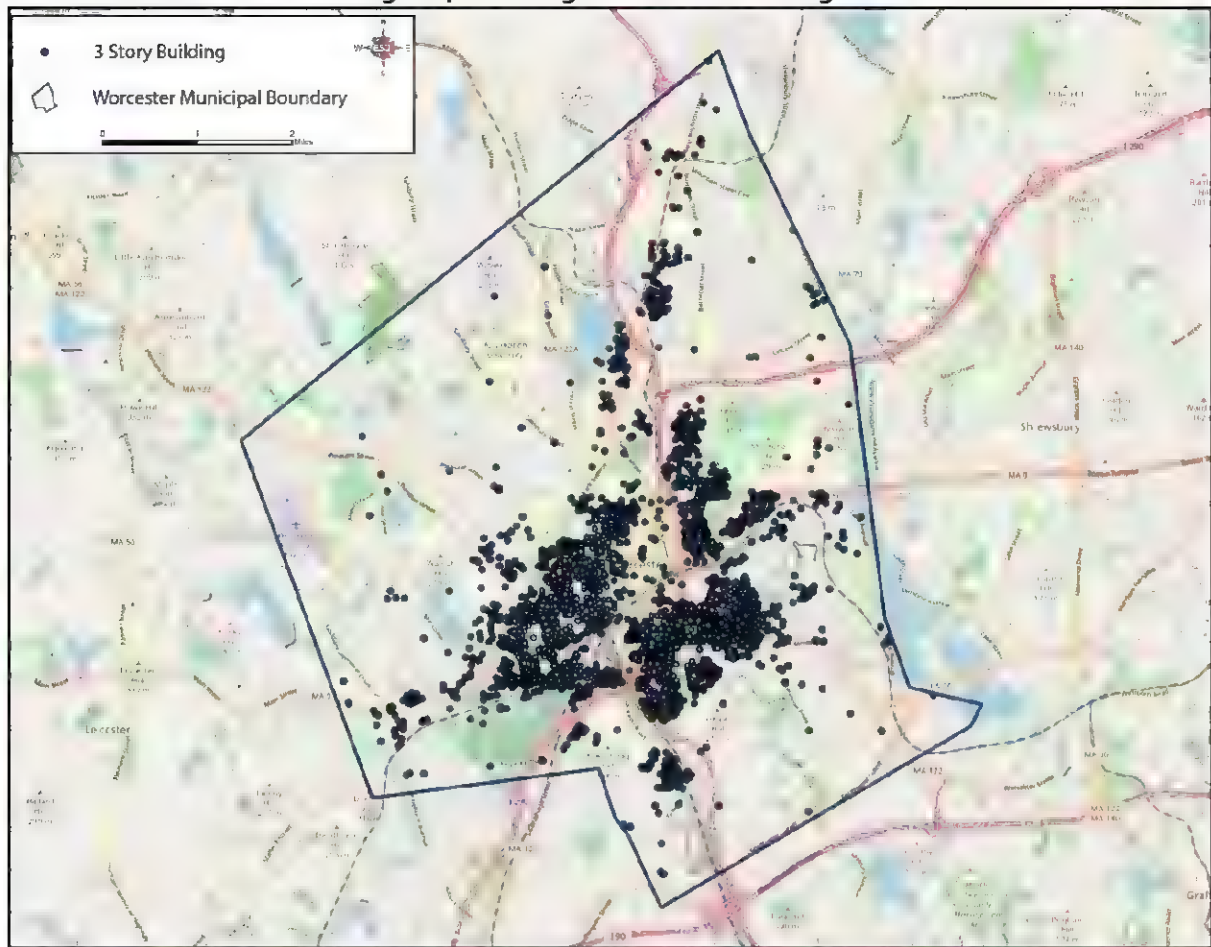
Buildings Three or More Stories in Height

The Insurance Services Office calls for a ladder truck within 2.5 miles of developed areas containing buildings three or more stories in height. Accessing the upper floors and roofs of buildings this tall typically requires ladder truck capability as ground ladders may not provide access. The following figure shows the locations of ladder company stations and that portion of the city which lies within 2.5 miles of a ladder company. This would be an EMS response time consideration as well as a fire suppression issue because of the vertical response time necessary to reach the patients.

Figure 45. Roads Within 2.5 Miles of a Ladder Company



In the next figure, the locations of buildings three stories in height are displayed. In Worcester, these can most likely be characterized as triple-deckers, particularly given the location where these buildings occur. Triple-deckers present challenges for the fire department due to their close proximity to one another, limited access, narrow road network, and often the steep grade in the area where they are constructed.

Figure 46. Buildings Three Stories in Height

Located predominately in and around downtown, the locations of these structures also correlate with the areas of greatest incident density from Figure 8.

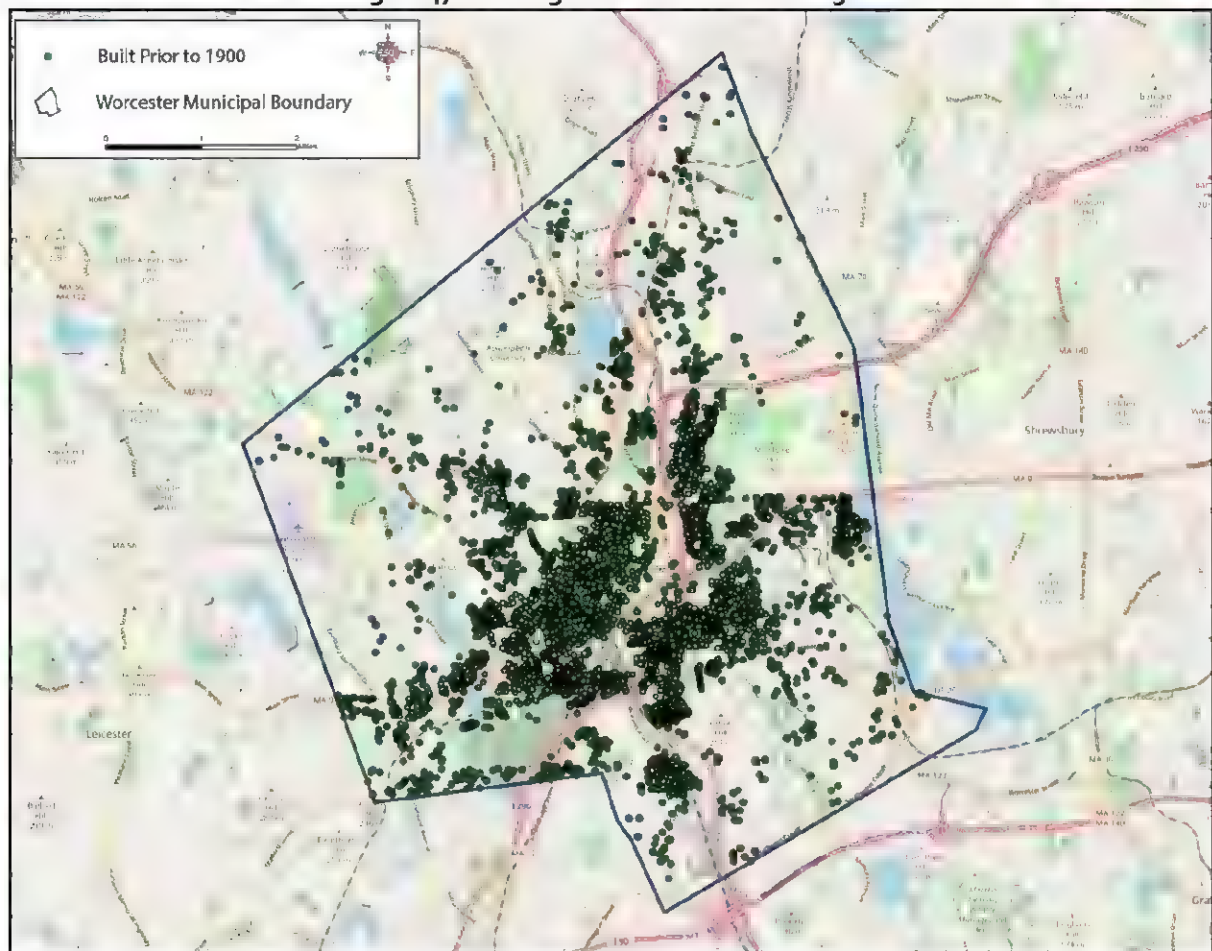
Large Square Footage Buildings

Large buildings such as warehouses, malls, and large “box” stores require greater volumes of water for firefighting and require more firefighters to advance hose lines long distances into the building.

Aging Buildings

The age of a building can greatly affect the conditions and level of difficulty encountered when conducting suppression or search and rescue operations. Buildings constructed prior to the development and enforcement of modern fire codes can allow fires to move quickly from one area of the building to another without being detected, and as buildings age, they can also become unstable unless ongoing home maintenance and care have occurred. In the next figure, buildings constructed prior to 1900 are displayed.

Figure 47. Buildings Constructed Prior to 1900



Similar to the locations where low income, homeownership, and education occur, the age of the building can be indicative of its fire risk. When the risk factors for general construction are coupled with behavioral and demographic risk factors, the potential for fire and fire-related injuries increases.

The Worcester Hazard Mitigation Plan

In Worcester's Hazard Mitigation Plan (HMP), risk prioritization was determined by evaluating the following elements: Hazard Description, Location, Extent, Previous Occurrences, Probability of Future Events, Impact, and Vulnerability.

Hazard Description is defined in the HMP as the natural hazards identified for Worcester: Dam Failure, Drought, Earthquakes, Extreme Temperatures, Flooding, Hurricanes, Severe Snowstorms/Ice Storms/Nor'easters, Severe Thunderstorms/Tornadoes/Wind, and Wildfire/Brushfire. Many of these hazards result in similar impacts to a community, and some are interconnected. For example, hurricanes, tornadoes, and severe snowstorms may cause wind-related damage. Severe thunderstorms may cause flooding, etc.³¹

Location refers to the geographic areas within the planning area that are affected by the hazard. Some hazards affect the entire planning area universally, while others apply to a specific portion, such as a floodplain or area susceptible to wildfires. Classifications are based on the area that would potentially be affected by the hazard, on the following scale:

Figure 48. Affected Land Area³²

Percentage of City Impacted by Natural Hazard	
Land Area Affected by Occurrence	Percentage of City Impacted
Large	More than 50%
Medium	10–50%
Small	Less than 10%

Extent describes the strength or magnitude of a hazard. Where appropriate, the extent is described using an established scientific scale or measurement system. Other descriptions of extent include water depth, wind speed, and duration. Previous hazard events that have occurred are described. Depending on the nature of the hazard, events listed may have occurred on a local, state-wide, or regional level. The probability of future occurrences is estimated by the number of past events. The likelihood of a future event for each natural hazard was classified according to the following scale.

³¹ <http://www.cmrpc.org/worcester-hazard-mitigation-plan>

³² <http://www.cmrpc.org/worcester-hazard-mitigation-plan>

Figure 49. Frequency of Occurrence and Annual Probability of Given Natural Hazard³³

Frequency of Occurrence	Probability of Future Events
Very High	70–100%
High	40–70%
Moderate	10–40%
Low	1–10%
Very low	Less than 1%

Impact refers to the effect that a hazard may have on the people and property in the community, based on the assessment of the extent described above. Impacts are classified according to the following scale.

Figure 50. Impacts, Magnitude of Multiple Impacts Given Natural Hazard³⁴

Impacts	Magnitude of Multiple Impacts
Catastrophic	Multiple deaths and injuries possible. More than 50% of property in the affected area is damaged or destroyed. Complete shutdown of facilities for 30 days or more.
Critical	Multiple injuries possible. More than 25% of property in the affected area is damaged or destroyed. Complete shutdown of facilities for more than 1 week.
Limited	Minor injuries only. More than 10% of property in the affected area is damaged or destroyed. Complete shutdown of facilities for more than 1 day.
Minor	Very few injuries, if any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of facilities.

Based on the above metrics, a hazard index rating was determined for each hazard. The hazard index ratings are based on a scale of 1 through 5 as follows:

- 1 – Highest risk
- 2 – High risk
- 3 – Medium risk
- 4 – Low risk
- 5 – Lowest risk

The ranking is qualitative and is based, in part, on local knowledge of past experiences with each type of hazard. The size and impacts of a natural hazard can be unpredictable. However, many of the mitigation strategies currently in place and many of those proposed for implementation can be applied to the expected natural hazards, regardless of their unpredictability.

³³ <http://www.cmrpc.org/worcester-hazard-mitigation-plan>

³⁴ <http://www.cmrpc.org/worcester-hazard-mitigation-plan>

Figure 51. Hazard Identification and Analysis³⁵

Type of Hazard	Location of Occurrence	Probability of Future Events	Impact	Hazard Risk Index Rating
Dam Failure	Small	Very Low	Limited	4
Drought	Large	Very Low	Minor	4
Earthquakes	Large	Very Low	Minor	5
Extreme Temperatures	Large	Moderate	Limited	4
Flooding	Medium	Moderate	Minor	2
Hurricanes	Large	Low	Limited	3
Severe Snowstorms/Ice Storms/Nor' Easter	Large	Very High	Limited	2
Severe Thunderstorms	Small	High	Minor	2
Tornadoes	Small	Very Low	Limited	4
Wildfires	Medium	Moderate	Minor	4
Winds	Small	Moderate	Limited	2

³⁵ <http://www.cmrpc.org/worcester-hazard-mitigation-plan>

Risk Prioritization

In her recent article, *3 Elements of an Effective Fire Department Community Risk Assessment*, Dr. Lori Moore-Merrell provided the following explanation for the three main elements that should provide the foundation for all Community Risk Assessments:³⁶

Figure 52. Community Risk Assessment Elements

Community Risk Assessment Element	Description
Probability (likelihood) of an incident occurring.	Probability is associated with the frequency of an incident type. Incidents with high probability will occur more frequently. Once these predictions are made, risks can then be ranked as having a low, moderate, or high probability of occurring.
Consequence (magnitude) of an incident on the community.	Consequence is the measure of the outcome of an incident type occurrence. To assess consequence, fire department leaders must first identify, categorize, and prioritize community hazards. Hazards are the causes of danger and peril in the community. Risk quantifies the degree of potential danger the hazard presents. The consequences of an emergency incident result from a combination of the risk level of the hazard, the duration and nature of the event, and the response interventions. Consequences are divided into four categories: <ul style="list-style-type: none"> ▪ Civilian and firefighter injury or loss of life ▪ Property damage or loss ▪ Critical infrastructure damage or loss ▪ Environmental damage or loss
Impact of an incident on the department's response system.	Impact is a measure that explains the effects of multiple concurrent incidents on the fire department. Impact describes a fire department's ability to provide ongoing services to the remaining areas of a community considering frequent activity in known high-volume demand areas.

³⁶ <https://www.lexipol.com/resources/blog/3-elements-of-an-effective-fire-department-community-risk-assessment/>

Establishing Community Risk Priorities

After the risks within a community have been identified and prioritized, the community is well-positioned to develop an effective set of Community Risk Reduction strategies and tactics to mitigate the risks.

Figure 53. Community Risk Reduction Planning Cycle



The NFPA defines Community Risk Reduction (CRR) as “programs, actions, and services used by a community, which prevent or mitigate the loss of life, property, and resources associated with life safety, fire, and other disasters within a community.” Vision 20/20 describes Community Risk Reduction as a “process to identify and prioritize local risks, followed by the integrated and strategic investment of resources (emergency response and prevention) to reduce their occurrence and impact.” In both instances, the previously identified and prioritized hazards form the basis for Community Risk Reduction Programs in an effort to save lives and property.

Figure 54. Community Risk Reduction Planning Considerations



Risk Assessment by First Due District

FEMA defines target hazards as “facilities in either the public or private sector that provide essential products and services to the general public, are otherwise necessary to preserve the welfare and quality of life in the community, or fulfill important public safety, emergency response, and/or disaster recovery functions.” The NFPA further breaks these down into three risk categories for occupancies.

- **High-Risk Occupancy:** An occupancy that has a history of a high frequency of fires, high potential for loss of life or economic loss, or that has a low or moderate history of fires or loss of life, but the occupants have a high dependency on the built-in fire protection features or staff to assist in evacuation during a fire or other emergency.
- **Moderate-Risk Occupancy:** An occupancy that has a history of a moderate frequency of fires or moderate potential for the loss of life or economic loss.
- **Low-Risk Occupancy:** An occupancy that has a history of a low frequency of fires and minimal potential for life or economic loss.

To provide a visual illustration of the areas of critical need in the City of Worcester, ESCI has produced *Risk Assessment by First Due District Maps* for each Worcester Fire Department first due response area. These maps attribute a risk classification of low-, medium-, and high-risk to each parcel within individual station response areas. Specific Community Risk Priorities are included within the *Recommended Future Delivery System Models* section of this report.

A portion of the data used by ESCI to compile the *Risk Assessment by First Due District Maps* was compiled with the assistance of FireCARES: *Community Assessment/Response Evaluation System*. The content reproduced from the FireCARES Database remains the property of FireCARES and contributing fire departments. The FireCARES team and partners are not responsible for any claims arising from works based on the original data, text, tables, or figures. FireCARES uses publicly available land use records and associated information, and as such, the locality may have access to more recent and up-to-date records and information.

ESCI notes that this parcel data and risk rating system represents information contained at a national level and may vary from local data. For additional information, or to update specific parcel information, the Worcester Fire Department should visit www.FireCares.org.

Community risks were determined via statistical regression models that predict various types of risk as a function of community attributes. Five community risks were modeled separately for low-, medium-, and high-hazard structures. The community risks were:

- Number of reported structure fires
- Percentage of reported fires that spread beyond the room of origin
- Percentage of reported fires that spread beyond the room of origin and spread beyond the structure of origin
- Number of reported injuries resulting from structure fires
- Number of reported deaths resulting from structure fires

Community risks were estimated for each of three different classes of structures in a community, including low-, medium-, and high-hazard structures as categorized by the NFPA.

Identifying and Categorizing Community Risk

Community risk level is typically established through an overall profile of the community based on the unique mixture of demographics, socioeconomic factors, occupancy risk, fire management zones, and the level of services currently provided.

Consequences of community hazards, associated risk events, and fire department mitigation efforts may be divided into four categories.

- Civilian and firefighter injury or loss of life
- Property damage or loss
- Critical infrastructure damage or loss
- Environmental damage or loss

Each of these categories contains hazards and therefore risks relevant to emergency responders.

Characteristics of properties can have a significant impact on outcome and associated response requirements. Each property or structure in a community can be considered a hazard that carries inherent risks based on occupancy type and fire load.

Occupancy risk is a sublevel of property risk and is established through an assessment of the relative risk to life and property resulting from a fire inherent in a specific building/structure or in generic occupancy classes (e.g., high-rise residential).

The NFPA Fire Protection Handbook defines hazard levels of occupancies by types.

- **High-Hazard Occupancies:** High-rise buildings, hospitals, schools, nursing homes, explosive plants, refineries, public assembly structures, other high life hazard or large fire potential occupancies. Specific to Worcester, triple-decker buildings can be considered a high-hazard occupancy as their age, condition, extremely close proximity to one another, tendency to be used as boarding houses, and danger to firefighters dramatically increase their risk profile, as well as the potential for conflagrations.
- **Medium-Hazard Occupancies:** Apartments, offices, mercantile, and industrial occupancies that may require extensive use of firefighting forces.
- **Low-Hazard Occupancies:** One-, two-, or three-family dwellings and scattered small business and industrial occupancies.

Community risks were also estimated as a function of the socio-demographic and geographic characteristics of the locations (census tracts) of reported structure fires over a nine-year period (2007–2016), according to available NFIRS data. The socio-demographic attributes include:

- *Population characteristics* (e.g., size category of the department, population, number of males, age group counts, race counts)
- *Housing characteristics* (e.g., total housing units, total vacancies, size of the home, number of renters, age of units)
- *Household characteristics* (e.g., median household income, social vulnerability index)
- *Geographic region*

The final set of variables varied by model and were selected to ensure the best prediction of risk. Note that because deaths are rare, many departments will be predicted to have only a fractional number of deaths.

Community risks are not currently estimated for communities with populations less than 10,000 people because small departments are expected to behave differently from larger departments.

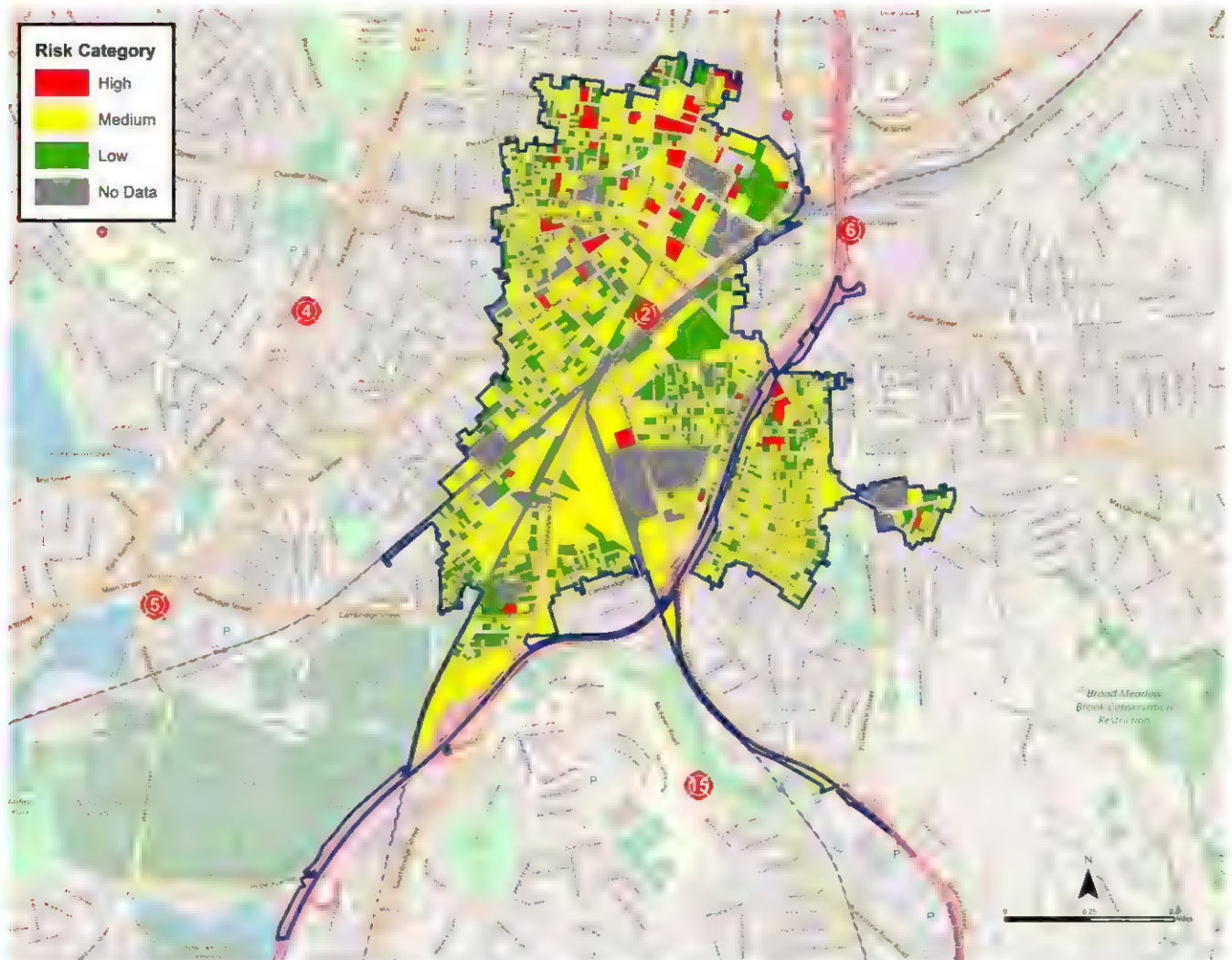


Worcester Fire Department

Risk Assessment By First Due District

Station 2

180 Southbridge St.



Station	2020 Total Population	2020 Household Population	2020 Family Population	2020 Population Density	2010-2020 Growth Rate Population	2020 Total Daytime Population	2020 Median Household Income	2019 HHs w/1 Persons w/Disability (ACS 5-Yr)
2	16,981	15,900	10,517	11,479.90	0.71	20,728	\$31,697	2,094.00

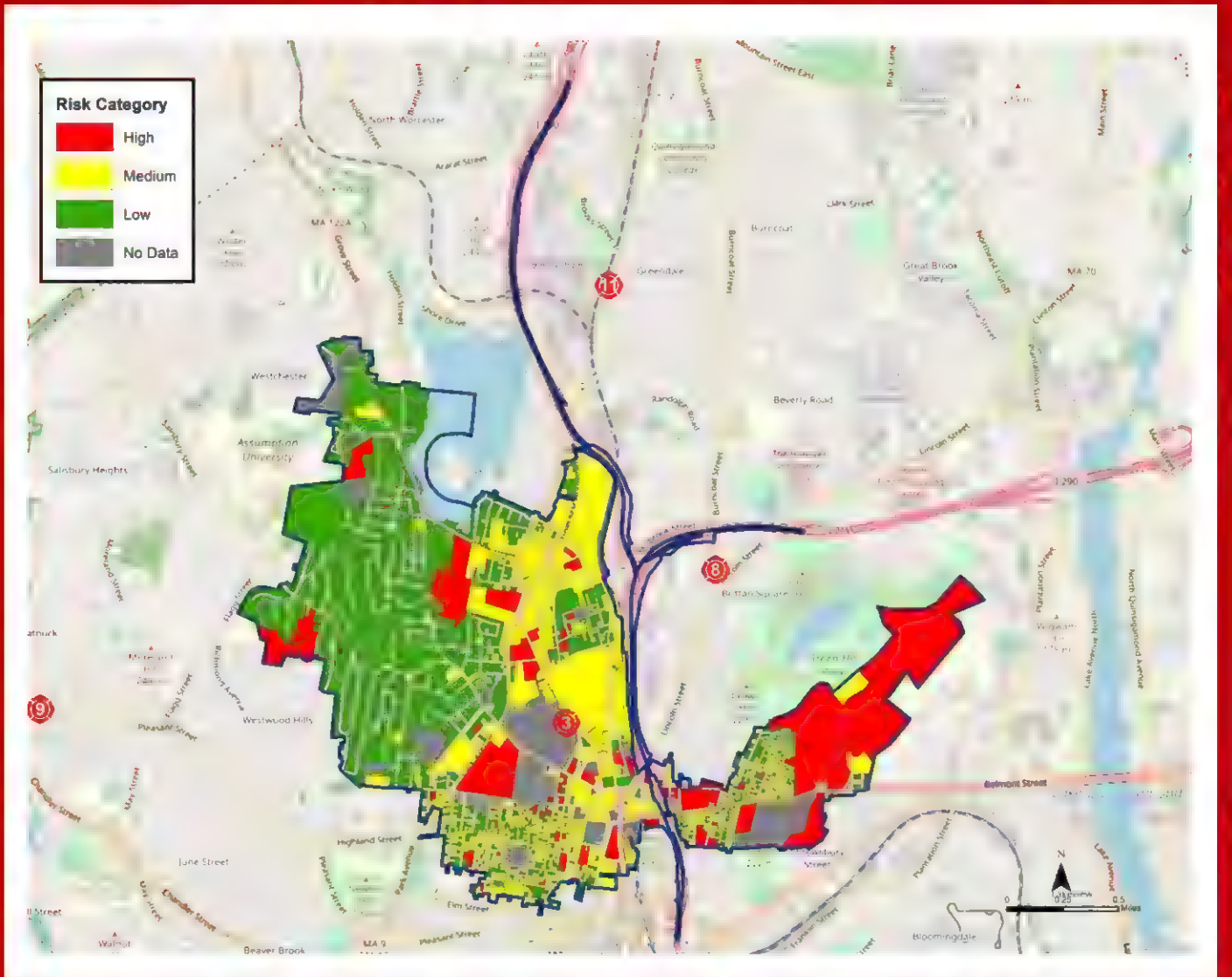


Worcester Fire Department

Risk Assessment By First Due District

Station 3

141 Grove St.



Station	2020 Total Population	2020 Household Population	2020 Family Population	2020 Population Density	2010-2020 Growth Rate: Population	2020 Total Daytime Population	2020 Median Household Income	2019 HHs w/ 1 Persons w/ Disability (ACS 5-Yr)
3	17,112	14,037	8,712	5,339.20	0.34	24,731	\$43,359	1,811

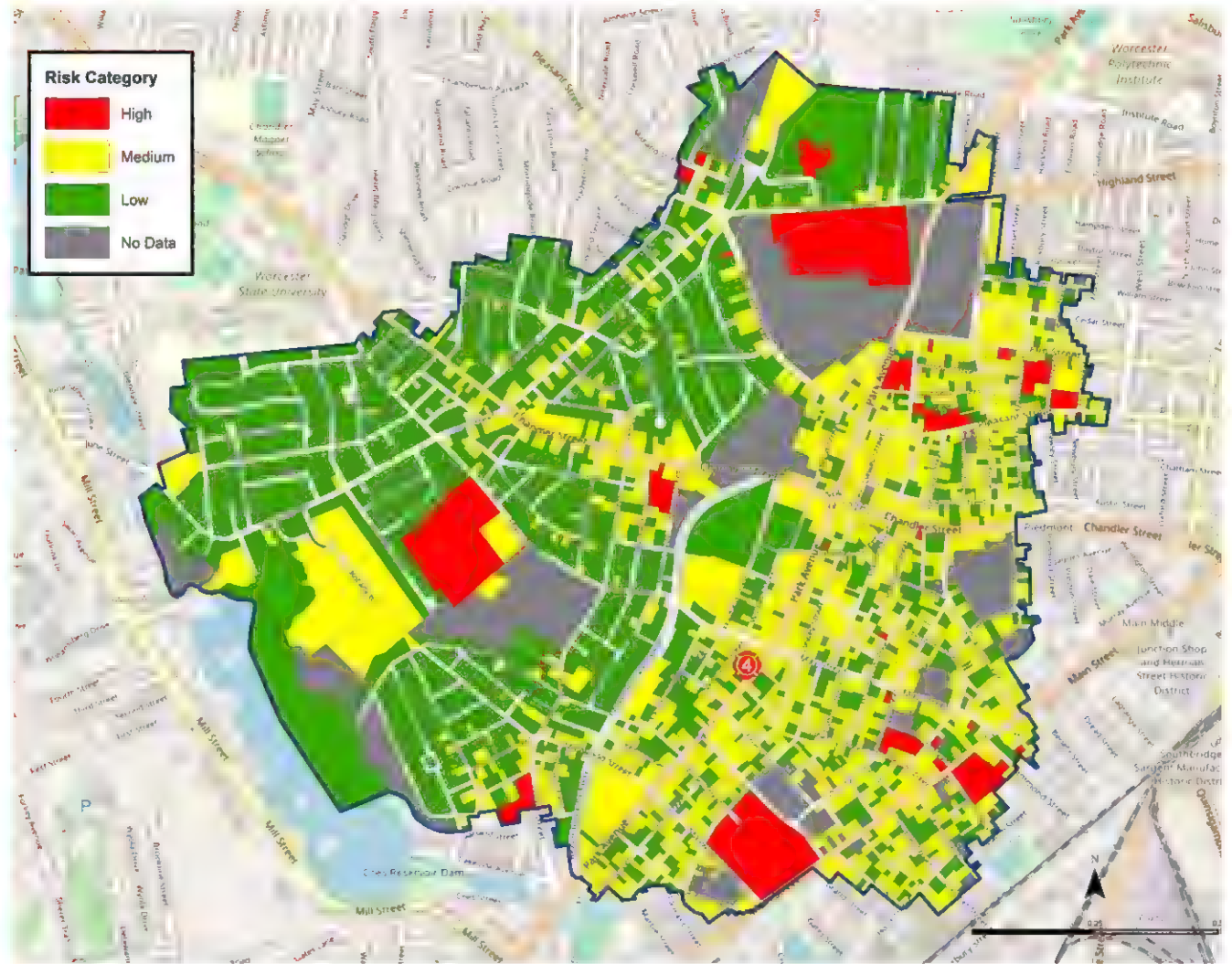


Worcester Fire Department

Risk Assessment By First Due District

Station 4

424 Park Ave.



Station	2020 Total Population	2020 Household Population	2020 Family Population	2020 Population Density	2010-2020 Growth Rate: Population	2020 Total Daytime Population	2020 Median Household Income	2019 HHs w/1 Persons w/Disability (ACS 5-Yr)
4	22,028	20,001	14,344	10,129.70	0.47	20,753	\$40,136	2,144

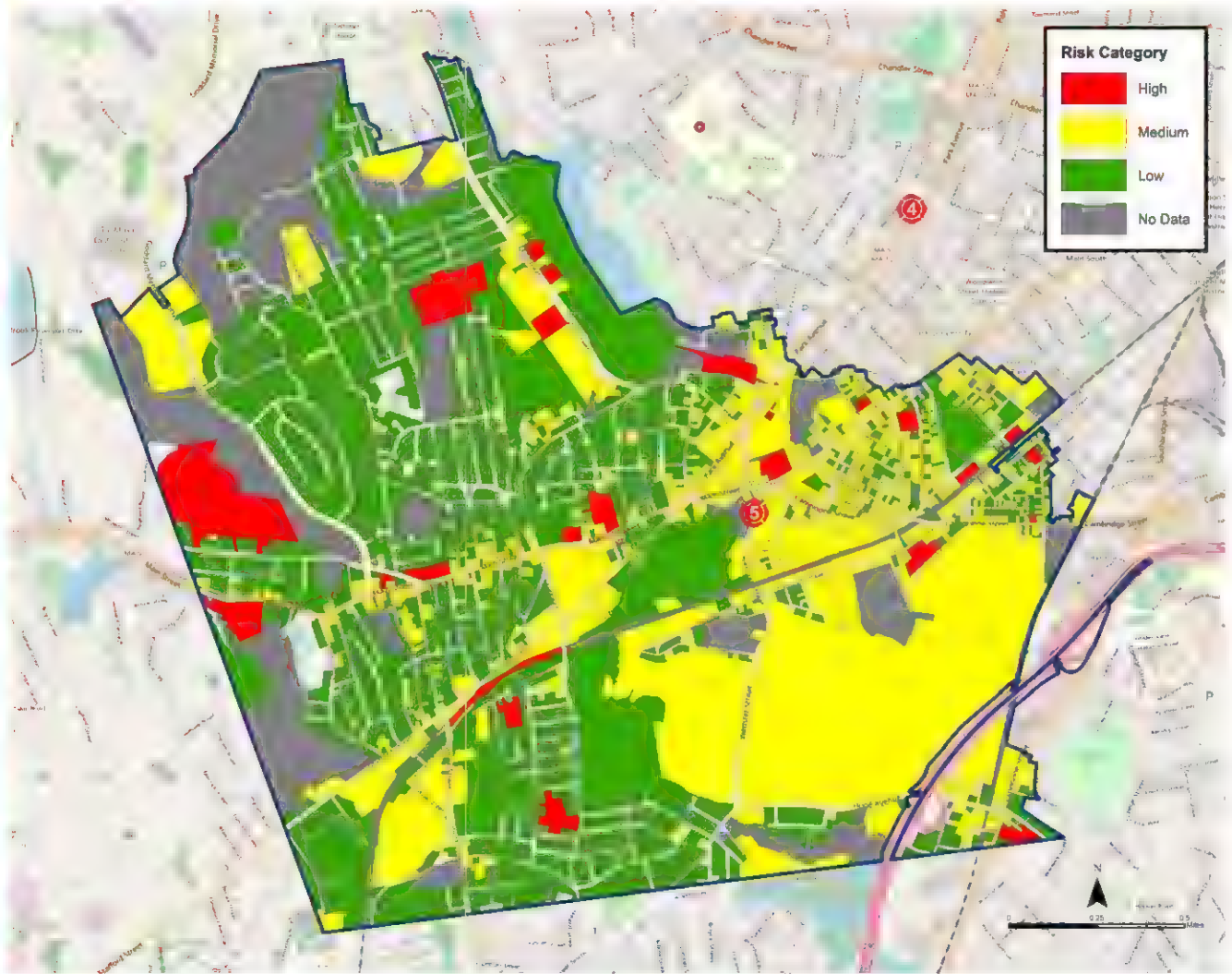


Worcester Fire Department

Risk Assessment By First Due District

Station 5

40 Webster St.



Station	2020 Total Population	2020 Household Population	2020 Family Population	2020 Population Density	2010-2020 Growth Rate: Population	2020 Total Daytime Population	2020 Median Household Income	2019 HHs w/ 1 Persons w/ Disability (ACS 5-Yr)
5	20,454	19,986	15,318	4,638.70	0.24	17,850	\$48,637	2,317

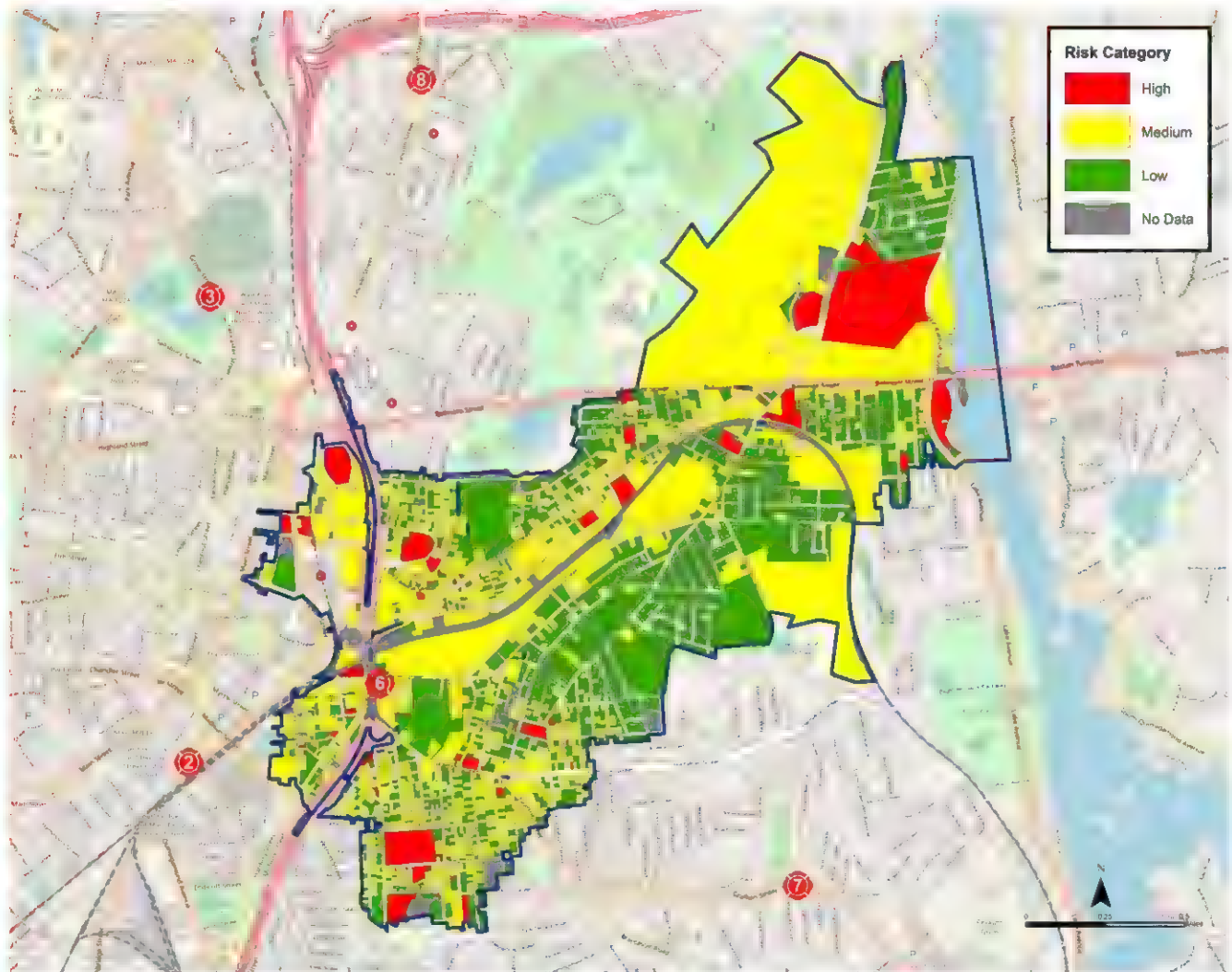


Worcester Fire Department

Risk Assessment By First Due District

Station 6

266 Franklin St.



Station	2020 Total Population	2020 Household Population	2020 Family Population	2020 Population Density	2010-2020 Growth Rate: Population	2020 Total Daytime Population	2020 Median Household Income	2019 HHs w/ 1 Persons w/ Disability (ACS 5-Yr)
6	17,894	17,399	12,626	6,282.30	0.26	28,361	\$39,312	\$2,520

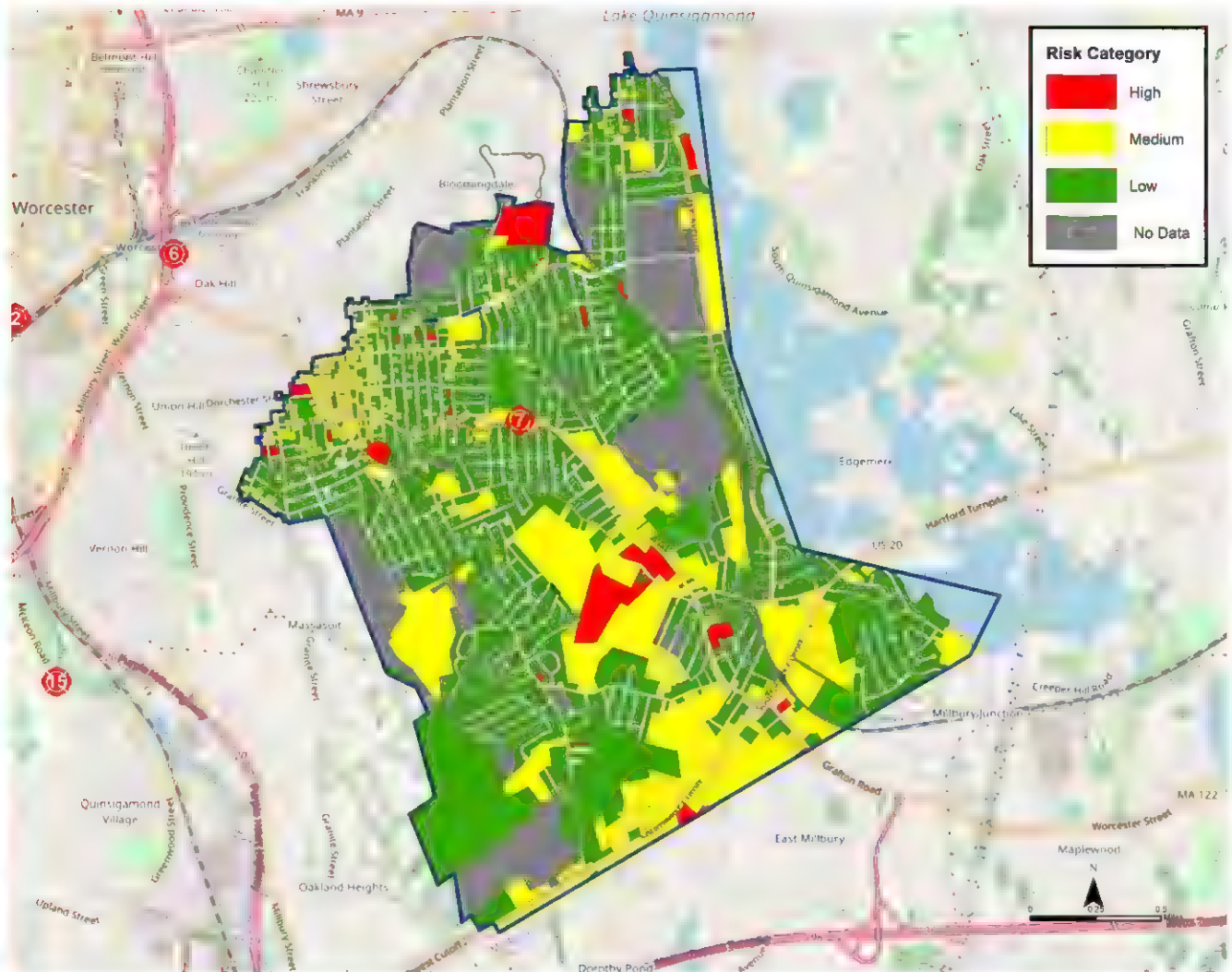


Worcester Fire Department

Risk Assessment By First Due District

Station 7

745 Grafton St.



Station	2020 Total Population	2020 Household Population	2020 Family Population	2020 Population Density	2010-2020 Growth Rate: Population	2020 Total Daytime Population	2020 Median Household Income	2019 HHs w/ 1 Persons w/ Disability (ACS 5-Yr)
7	19,992	19,938	14,942	4,466.40	0.54	16,624	\$60,362	1,763

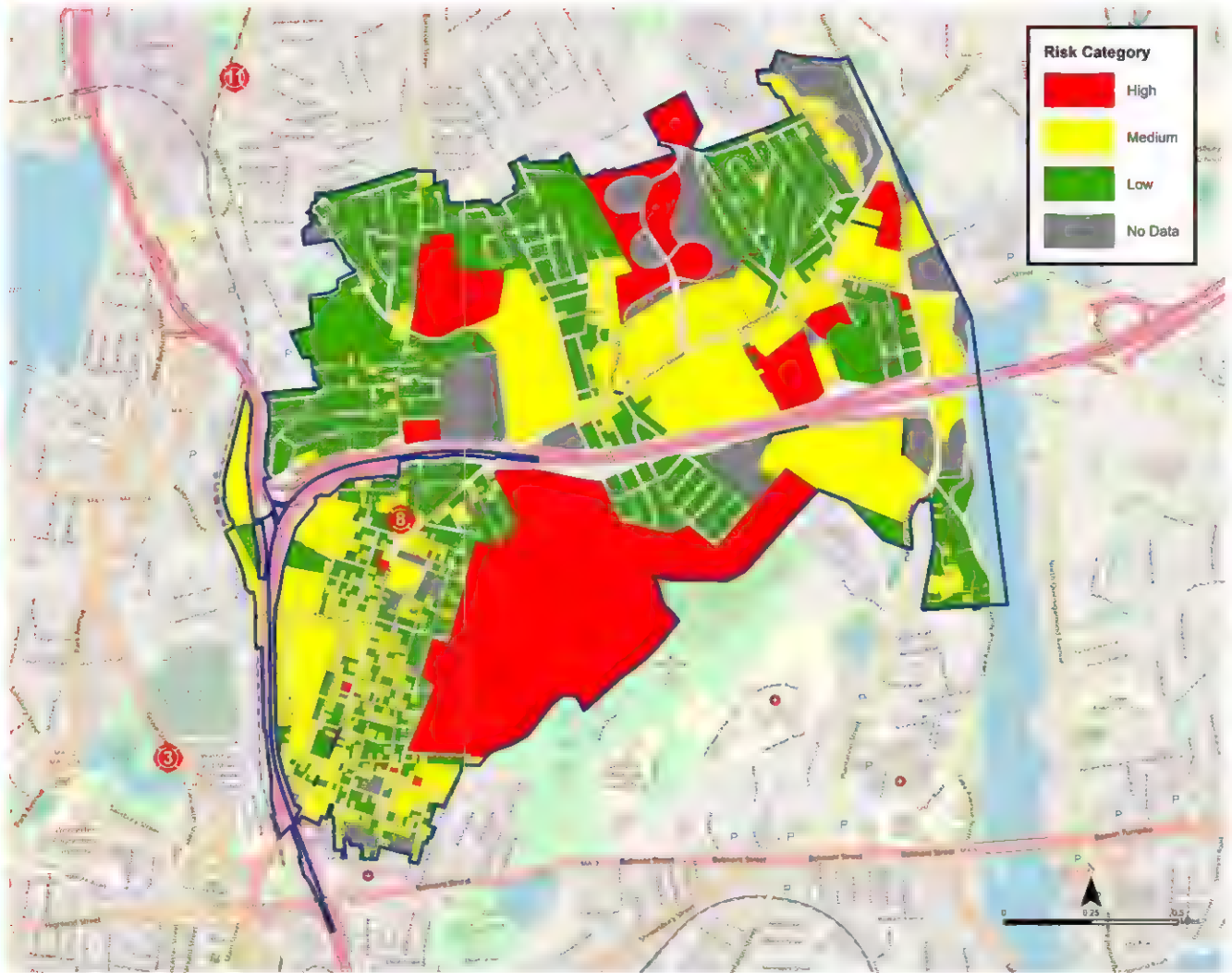


Worcester Fire Department

Risk Assessment By First Due District

Station 8

19 Burncoat St.



Station	2020 Total Population	2020 Household Population	2020 Family Population	2020 Population Density	2010-2020 Growth Rate: Population	2020 Total Daytime Population	2020 Median Household Income	2019 HHs w/ 1 Persons w/ Disability (ACS 5-Yr)
8	14,767	14,172	10,478	4,905.70	0.3	16,815	\$42,931	2,043

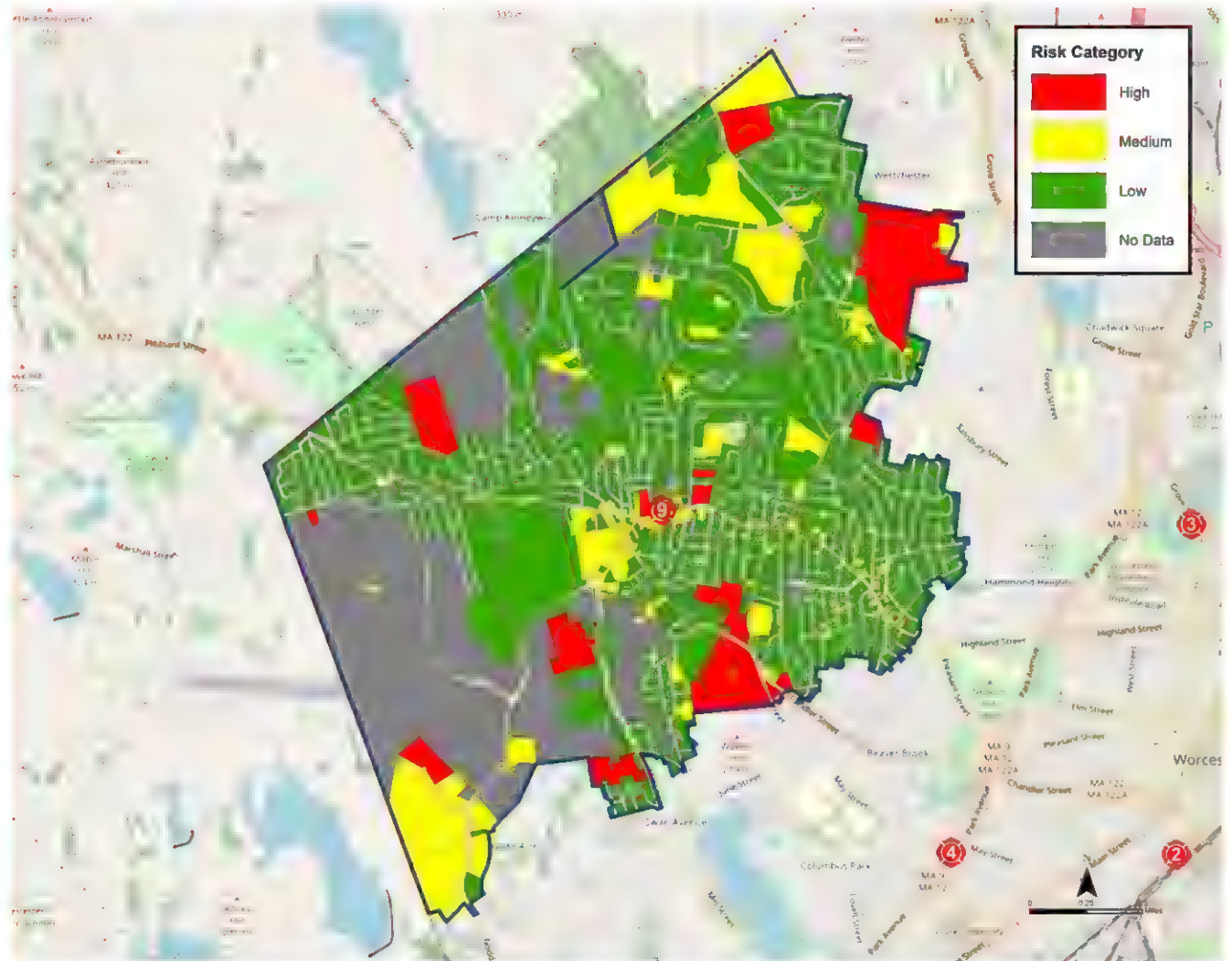


Worcester Fire Department

Risk Assessment By First Due District

Station 9

1067 Pleasant St.



Station	2020 Total Population	2020 Household Population	2020 Family Population	2020 Population Density	2010-2020 Growth Rate Population	2020 Total Daytime Population	2020 Median Household Income	2019 HHs w/1 Persons w/Disability (ACS 5-Yr)
9	19,949	17,954	14,576	3,003.50	0.35	18,043	\$83,150	1,435

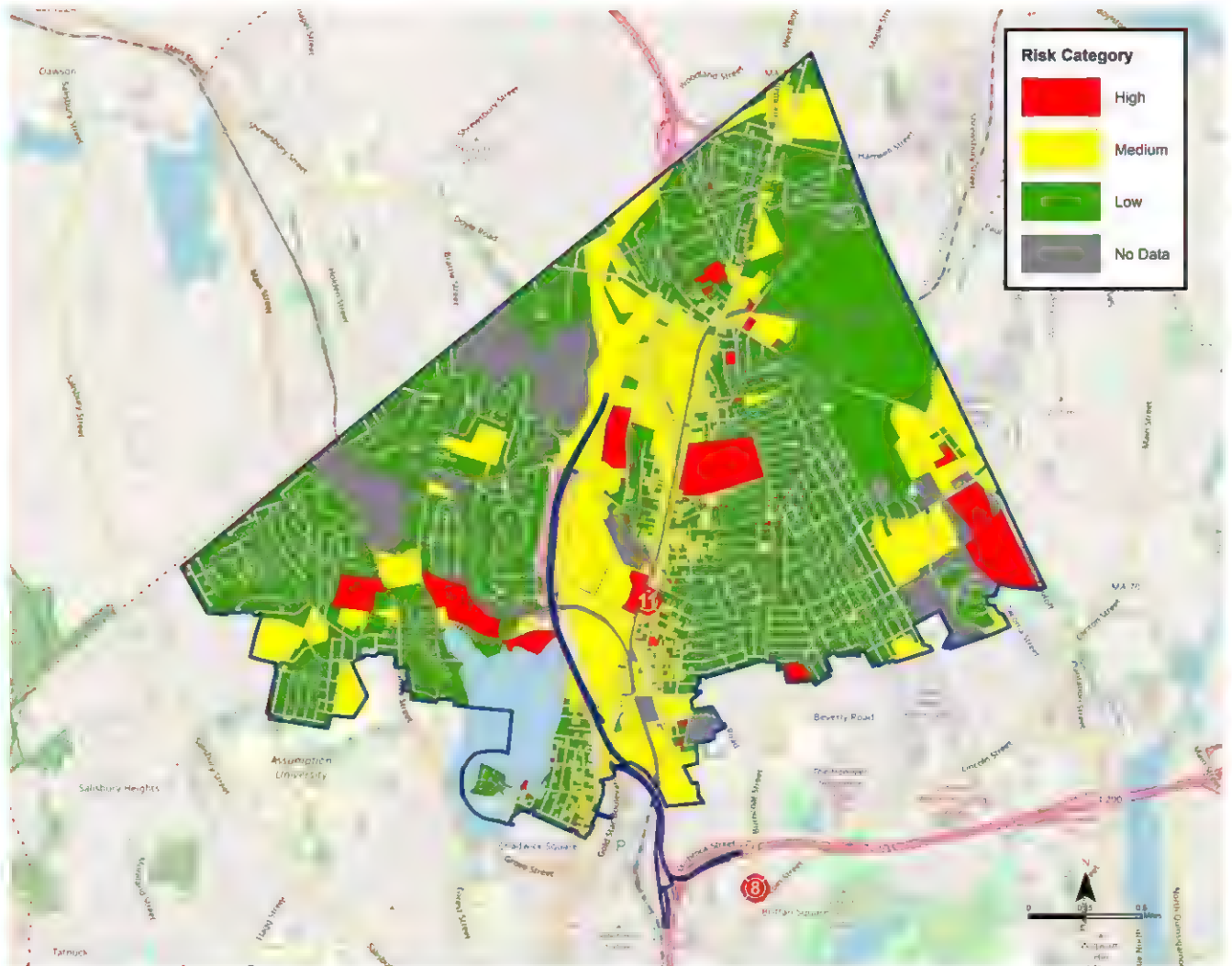


Worcester Fire Department

Risk Assessment By First Due District

Station 11

438 West Boylston St.



Station	2020 Total Population	2020 Household Population	2020 Family Population	2020 Population Density	2010-2020 Growth Rate: Population	2020 Total Daytime Population	2020 Median Household Income	2019 HHs w/ 1 Persons w/ Disability (ACS 5-Yr)
11	23,472	23,175	18,303	3,652.50	0.39	23,552	\$63,475	2,358

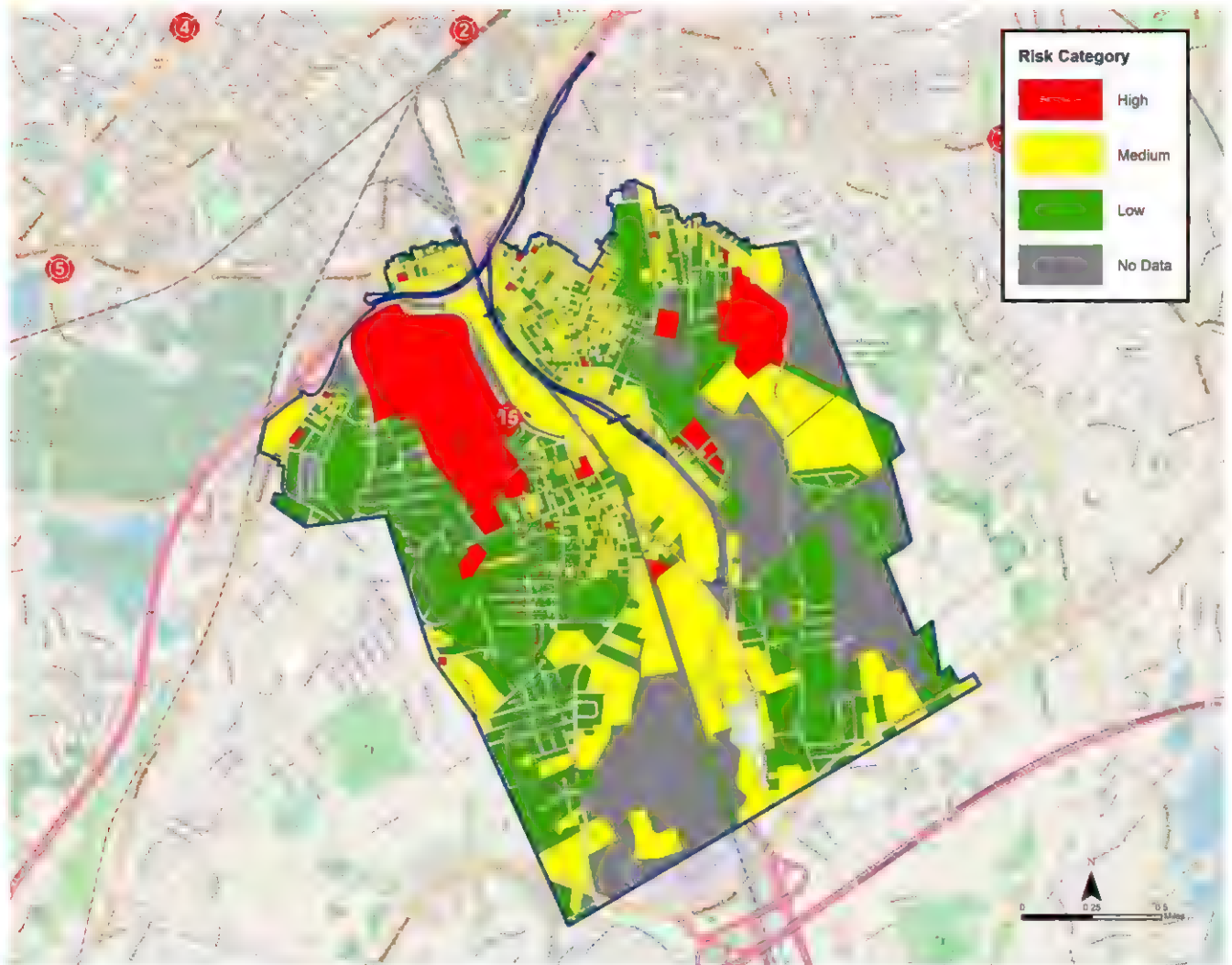


Worcester Fire Department

Risk Assessment By First Due District

Station 15

80 McKeon Rd.



Station	2020 Total Population	2020 Household Population	2020 Family Population	2020 Population Density	2010-2020 Growth Rate: Population	2020 Total Daytime Population	2020 Median Household Income	2019 HHs w/ 1 Persons w/ Disability (ACS 5-Yr)
15	16,120	13,497	9,623	4,251.40	0.5	14,311	\$48,060	1,867

Financial Analysis

Financial analysis is an important part of determining the long-term financial health and sustainability of the Worcester Fire Department as it works to achieve and maintain an acceptable level of service. A financial model was developed to fairly represent service level impacts and related budgetary practices in a consistent manner. This approach provides an estimation of the total public cost of the department's operation and a means for the financial evaluation of sustainability under status quo conditions and various service level modifications. The modeled budget yields a baseline estimate of the total cost of external and internal services provided by and to the department.

The following section provides background information on the historical and current financial condition of the Worcester Fire Department. Understanding of fire service financial resources and costs begins with an overview of the various revenues and expenditures which support the fire department and its operations across all programs. This includes a multi-year historical review of revenues and expenses followed by a status quo financial forecast from FY 22 through FY 26 utilizing historical trend data and key assumptions about future trajectory to the extent known. This analysis relies on extensive financial documentation provided by city and Worcester Fire Department staff, including the actual and adopted budget documents from FY 16–21, CIP and Human Resources financial data, and Worcester's comprehensive annual financial reports (CAFRs) and budget documents through FY 21. In order to build a complete picture of the cost of providing fire services, ESCI has compiled data from several different sources, formats, and city departments during a time when the city is transitioning to a new accounting system which has led to some data inconsistencies. The following analysis should be used with that caution in mind.

Fund Accounting

Local governments use an accounting system organized around a series of discrete funds to ensure appropriate accountability and segregation of revenues and expenses related to specific activities. The Governmental Accounting Services Board (GASB), an independent organization that develops and adopts standards of government accounting and reporting, defines a fund as "a fiscal and accounting entity with a self-balancing set of accounts recording cash and other financial resources, together with all related liabilities and residual equities or balances, and changes therein, which are segregated for the purpose of carrying on specific activities or attaining certain objectives in accordance with special regulations, restrictions or limitations."³⁷ In other words, a fund exists to capture all revenue, expense, and fund balance activity related to a specific function or set of activities.

³⁷ GASB Codification Section 1300; www.gasb.org.

There are three categories of funds: Governmental Funds, accounting for most governmental functions such as fire and police services, debt service, capital projects, and internal services; Proprietary or Enterprise Funds, accounting for business-type activities such as water, sewer, and golf services; and Fiduciary Funds, accounting for assets held by the government as an agent of which the city has two; the Pension Trust Fund which accumulates resources for qualified employee pension benefits and the Agency Fund which accounts for student activity funds. Fire department primary and supporting functions are typically found in Governmental funds, which is the case with the Worcester Fire Department.

Expenditures supporting fire department activities may, and often are, found in several different major and minor funds, which may relate to how revenue is generated.^{38,39} Funds may be wholly dedicated to a specific department, or they may comprise several different departments and functions such as the city's General, Capital Projects, Debt Service, and various Internal Service Funds. The analysis that follows compiles data from all pertinent funds to the extent that they contribute to and support the overall mission and various operations of the Worcester Fire Department except for the city Debt Service Fund. Some percentage of the city's annual debt service is attributable to fire department capital expenses funded through various debt instruments but is not shown in the following analysis.

The **General Fund** or GF is the city's largest and most diverse governmental fund accounting for the bulk of its revenue and expense, including general city government operations and both internal and external services such as fire/rescue. The primary GF revenue sources are ad valorem or property taxes, state aid for city operations, and education. Lesser sources include local receipts and other available funds.⁴⁰

The **Capital Improvement Projects Fund** is a governmental fund used to account for resources restricted, committed, or assigned to the acquisition, renovation, and/or construction of major capital facilities such as fire stations and other capital assets such as apparatus. Expenditures are often financed by long-term debt repaid from recurring GF operating revenues, 47.8% from ad valorem revenues, and the remainder from enterprise fund transfers and grant programs in the FY 21 adopted budget.⁴¹ The city has a formalized five-year Capital Improvement Program (CIP) and commits funding each year during the annual budget process to various projects approved during the CIP review process. Funds used are cash from fund balance, bond funds, and grants. Worcester Fire Department-related capital expenditures are budgeted in the appropriate General and Capital Projects Funds expenditure budgets depending upon the specific expenditure type and funding source.

³⁸ Major governmental funds are those shown separately within the City of Worcester CAFR such as the General and Debt Service Funds.

³⁹ Non-major governmental funds are those not considered separately in the City of Worcester CAFR but rather are shown in aggregate such as the Capital Projects Funds, Special Revenue Funds and Permanent Funds. The City maintains a non-major internal service fund to account for self-insured health costs. This fund is administered by the Human Resources Department.

⁴⁰ City of Worcester FY 2021 Adopted Annual Budget, p. 10.

⁴¹ City of Worcester FY 2021 Adopted Annual Budget, p. 22.

The city uses a current financial resources measurement focus and a modified accrual basis for budgeting and accounting in Governmental Funds. The city fiscal year runs from July 1 through June 30 of the following year. In May, the City Manager presents the recommended budget to the City Council, which has 45 days to make any reductions and final revisions prior to adoption with an effective date of July 1 each year.⁴²

Since the Worcester Fire Department operates as a General Fund department, but expenditures supporting fire department operations are made from multiple budgets and funds as discussed above, the following analysis presents combined fire-related revenue and expense as a composite intended to illustrate to the reader total department-specific revenue and total expense in one table. However, it should be noted that debt service on capital projects financed through various debt instruments is accounted for in the General Fund in aggregate along with other city projects. Specific debt for various fire department projects has not been included in the following analysis.

Further, while several internal service charges are included as expenditures in the Worcester Fire Department budget analysis that follows (primarily various facility and apparatus maintenance costs included in the GF Ordinary Maintenance budget), other internal services such as Human Resources, Technical Services, Law Department, Budget Division, and City Administration costs are not directly allocated to the expenditure budget. A proportionate share of these costs (5–10% of the operating budget is typically seen as a reasonable estimate for support service costs) would be included in a true full cost analysis of the department. Additionally, various personnel-related costs that are normally found within each department budget, such as health insurance, workers' compensation, retirement contribution, and other related costs, are budgeted separately and administered by the city's HR Department. To the extent that these costs were available, they are included as Benefits in the analysis below.

The Worcester Fire Department provides its annual GF budget information in aggregate as well as by five functional programs, including Fire Administration (2601), Fire Maintenance (2602), Fire Prevention (2603), Fire Training (2604), and Fire Suppression (2605). The bulk of its personnel and expenditures, approximately 90%, are assigned to the Fire Suppression function. Further, and as mentioned above, fire department capital expenditures are found with the various fire department programs found in the GF as well as CIP Fund.

⁴² *City of Worcester FY 2021 Adopted Annual Budget, p. 30.*

Historical Revenue and Expense

Revenue

The following figure shows actual fire-related revenues for the General Fund, which are divided into recurring and non-recurring revenues. Recurring revenues are those such as fees for service and inspection and permit fees, and other income streams that are reasonably predictable in many cases and expected to continue on a year-to-year basis. Non-recurring revenues, on the other hand, are more sporadic in nature and difficult to predict, such as grant (state and federal aid) funds, donations and sales of surplus property and equipment and insurance, and other reimbursements as well as various miscellaneous sources. Bond or loan proceeds, when applicable, are also considered non-recurring revenue sources but are not considered here since they provide undifferentiated funding for multiple department projects in the CIP Fund.

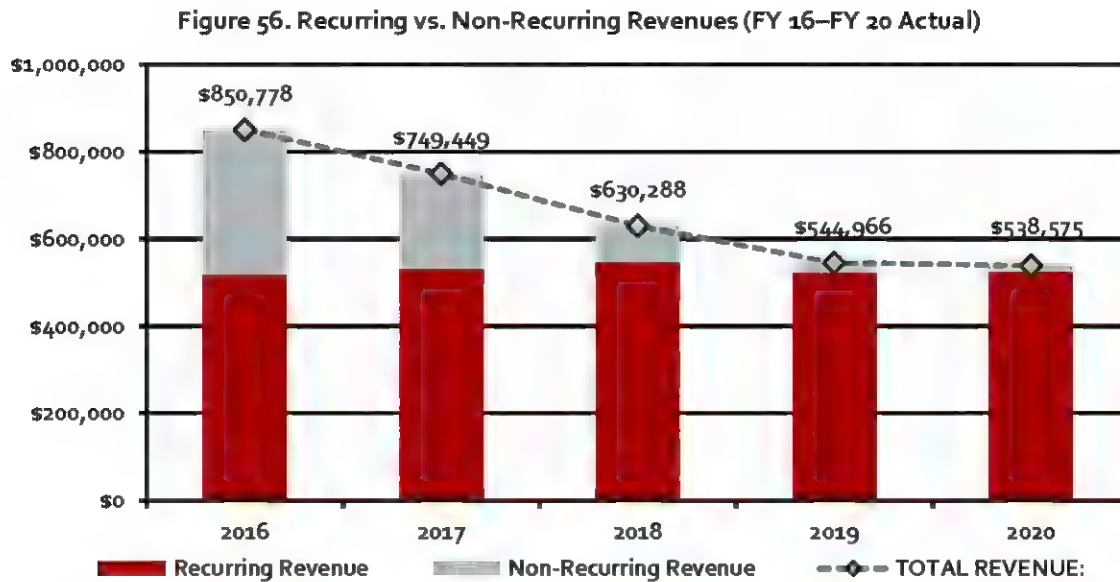
Figure 55. Worcester Fire Department Revenues (FY 16–FY 20 Actual)

Revenue	2016 Actual	2017 Actual	2018 Actual	2019 Actual	2020 Actual
Inspection/Permits Fees/Other	395,686	413,303	439,371	440,745	439,946
Ambulance Receipts	9,040	6,360	4,000	9,920	10,291
Alarms/Fines	113,876	111,647	103,485	72,170	74,930
Recurring Revenue	518,602	531,309	546,857	522,836	525,167
Credit Fed Rev	144,081	19,282	-	-	-
Hazmat Overtime	176,968	173,532	74,300	6,226	-
Grant Overtime	11,126	25,325	9,132	15,904	13,408
Non-Recurring Revenue	332,175	218,139	83,432	22,130	13,408
TOTAL REVENUE:	\$850,778	\$749,449	\$630,288	\$544,966	\$538,575

Fire department-specific recurring revenues supporting the department are relatively minor compared to the expenditure budget and have fluctuated slightly around an annual average of approximately \$530,000 between FY 16 and FY 20. Recurring revenue comes from several sources outlined in the following:

- **Inspection/Permit Fees/Other Revenues**—increased from \$395,686 in FY 16 to \$439,371 in FY 18 after which they remained flat, averaging \$440,000 through FY 20.
- **Ambulance Receipts**—this minor component of recurring revenue has fluctuated around an average of approximately \$8,000 between FY 16 and FY 20.
- **Alarms/Fines**—this revenue source has declined steadily from a high of just under \$114,000 in FY 16 to an average of near \$73,000 in FY 19 and FY 20.

Non-recurring revenues supporting the department, as expected, have continually decreased from a high of \$332,175 in FY 16 to an average of near \$18,000 in FY 19–20. Non-recurring revenues are driven primarily by various federal grants and hazmat response reimbursements. The following figure compares recurring to non-recurring and total revenue for the department and clearly shows the impact of decreasing grant and response reimbursement funding on the total revenue stream.



Expense

The following figure shows actual Worcester Fire Department General Fund operating and capital expenditures. Worcester Fire Department capital expenses estimated from annual CIP documents are included with GF capital expenses but may not reflect actual expenditures in the year shown. Expenses for the period FY 16–20 actual and FY 21 adopted are divided into recurring and non-recurring expenses. Recurring expenses are those such as employee wages and benefits and various functional operating costs that are reasonably predictable and expected to continue from year to year. To simplify the analysis, ESCI has grouped Ordinary Maintenance line items into the five major categories shown in the following figure: Administrative/Overhead costs, Apparatus, Facilities, Personnel, and Supplies & Equipment.

Figure 57. ESCI Grouping of Ordinary Maintenance Line Items

Ordinary Maintenance Expense Categories				
Admin/Overhead	Apparatus	Facilities	Personnel	Supplies & Equipment
Audio/Visual Supplies	Auto Fuel No Lead Gas	Building Supplies	Badges and Plates	Batteries
Consultants	Auto Inspection Fees	Cleaning Services	Books	Chemical Supplies
Copy Paper	Automotive Supplies	Custodial Supplies	Educational Supplies	Hardware/Devices
Hired Services	Diesel Fuel	Electricity	Meals	Hardware Supplies
Leases & Rentals	Maint/Rep Vehicle	Environmental Services	Membership Dues	Maint/Rep Equipment
Maint System Software	Maintenance & Repair	Exterminator Services	Other Personal Services	Medical Supplies
Newspaper Advertising		Flags	Psychologist/Behavioral Svc	Other Supplies
Office Supplies		Maint/Rep Buildings	Registration Fees	Parts/Equipment Supplies
Other Charges & Expenditures		Maint/Rep Furnishings	Training Certifications	Safety Supplies
Physicians/Surgeons		Natural Gas	Transportation	
Postage		Rubbish Removal	Traveling	
Printing		Telephone	Uniforms	
Printing Supplies		Water		

In the case of some larger fire departments, fleets are so large that replacement can be well planned and cycled such that departments can spend a predictable, uniform amount each year on apparatus and equipment replacement. Typically, they consider this a recurring cost and can budget such with an offsetting recurring revenue. The Worcester Fire Department follows industry standards with a long-range apparatus replacement plan based upon various factors such as age, mileage, use, and condition as well as annual repair versus replacement cost for various apparatus classes. The Worcester Fire Department apparatus replacement plan is variably funded as part of the city CIP.

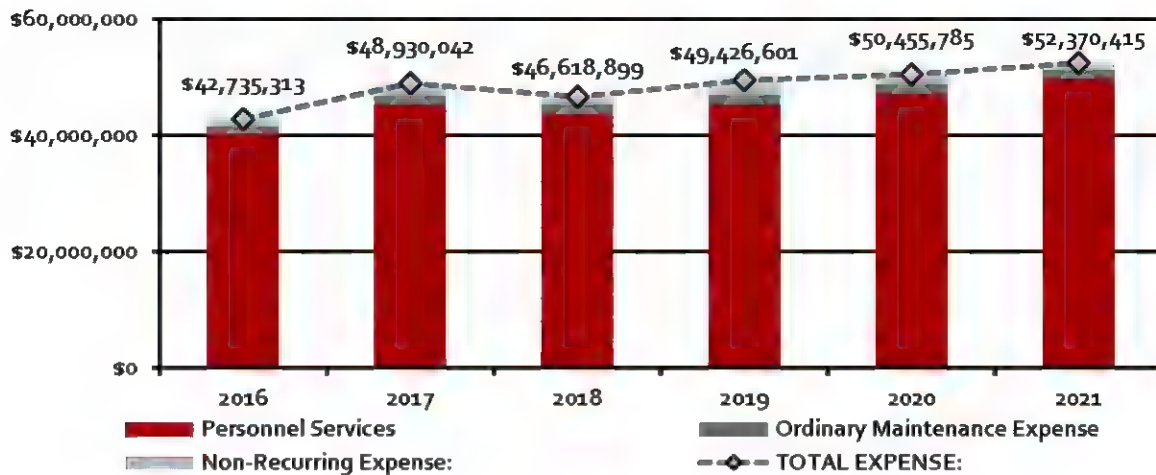
Non-recurring expenses are typically sporadic in nature and may be difficult to predict, such as land acquisition, facility construction and major facility renovation, and large-scale equipment or apparatus purchases. In this analysis, all capital expenditures are shown as non-recurring expenses. Fire department-related expenses may be found directly in the department's General Fund expenditure budget and the city Capital Improvement Project Fund budget. The city maintains and utilizes a rolling five-year Capital Improvement Plan (CIP). Each year the initial year's projects approved for the various submitting departments are funded using various sources in the city's CIP budget. Those fire department-related projects are shown in the following analysis.

Figure 58. Worcester Fire Department Expenses (FY 16–FY 20 Actual; FY 21 Adopted)

Expense	2016 Actual	2017 Actual	2018 Actual	2019 Actual	2020 Actual	2021 Adopted
Personnel Serv	40,421,720	45,324,490	43,799,267	45,365,810	47,256,803	49,774,509
Salaries & Wages	31,879,435	36,458,046	34,888,439	36,258,093	37,528,026	39,561,209
<i>Regular</i>	30,530,077	35,185,747	33,695,235	34,834,894	35,874,685	38,409,033
<i>Overtime</i>	1,349,358	1,272,299	1,193,204	1,423,199	1,653,341	1,152,176
Benefits	8,542,285	8,866,444	8,910,828	9,107,717	9,728,777	10,213,300
Ordinary Maint	1,217,280	1,568,222	1,515,932	1,646,846	1,552,881	1,560,958
Admin/Overhead	49,567	30,242	63,017	50,396	85,568	208,563
Personnel	102,085	139,150	273,913	412,055	279,832	256,166
Facilities	240,154	332,503	487,920	451,840	447,485	460,896
Apparatus	427,184	573,977	467,454	473,460	537,218	388,000
Supplies/Equip	398,290	492,351	223,628	259,096	202,778	247,333
Recurring Exp:	41,638,999	46,892,713	45,315,199	47,012,656	48,809,685	51,335,467
Bldgs/Improvements	102,900	1,378,800	0	0	210,000	14,320
Furniture & Fixtures	38,414	2,529	32,460	53,511	689,600	0
Apparatus	930,000	600,000	1,139,190	2,304,562	668,500	731,628
Safety/Other Equip	25,000	56,000	132,050	55,871	78,000	289,000
Non-Recur Exp:	1,096,314	2,037,329	1,303,700	2,413,944	1,646,100	1,034,948
TOTAL EXPENSE:	\$42,735,313	\$48,930,042	\$46,618,899	\$49,426,601	\$50,455,785	\$52,370,415

The following figure compares recurring, non-recurring, and total department expense (less any department-related debt service and central service costs) from FY 16 through FY 20 actual and FY 21 as adopted. Total expenses have increased from \$42.7 million in FY 16 to \$50.45 million in FY 20, with fluctuation over the period driven by increasing personnel costs which comprise 93–94% of total expenditures over the period. Non-recurring costs are dominated by the acquisition of various apparatus over the period.

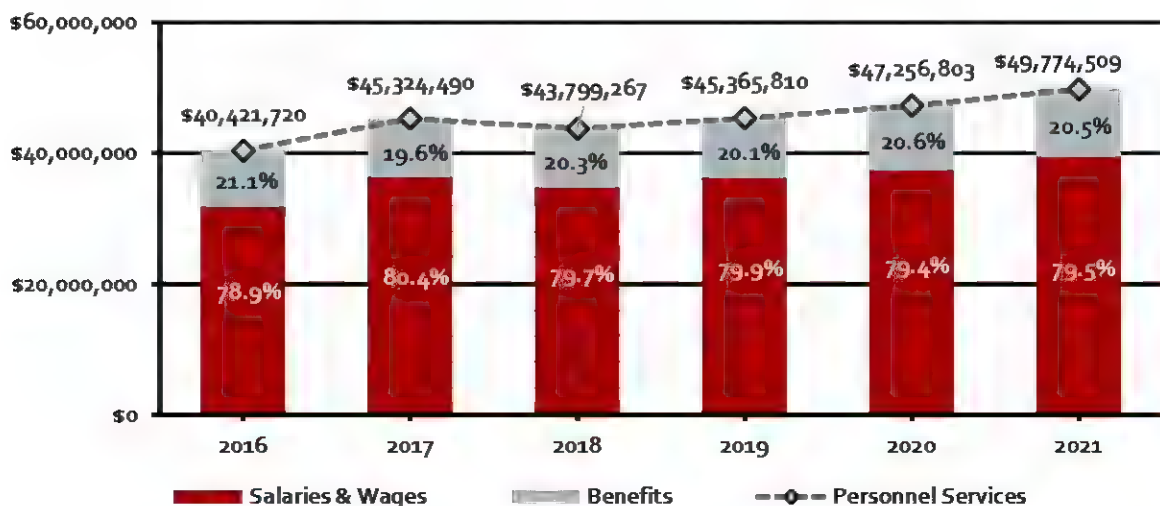
Figure 59. Recurring vs. Non-Recurring Expenses (FY 16–20 Actual; FY 21 Adopted)



Recurring expenses, again excluding the fire department portion of city debt service, for the department have increased over the period, rising at an average annual rate of 4.1% between FY 16 and FY 20. This increase was driven by personnel services costs which have increased at 4% annually, while Ordinary Maintenance costs have remained relatively flat, fluctuating around an average of just under \$1.57 million annually from FY 17 through FY 20, after an increase of \$350,000 between FY 16 and FY 17. The major categories are described as follows:

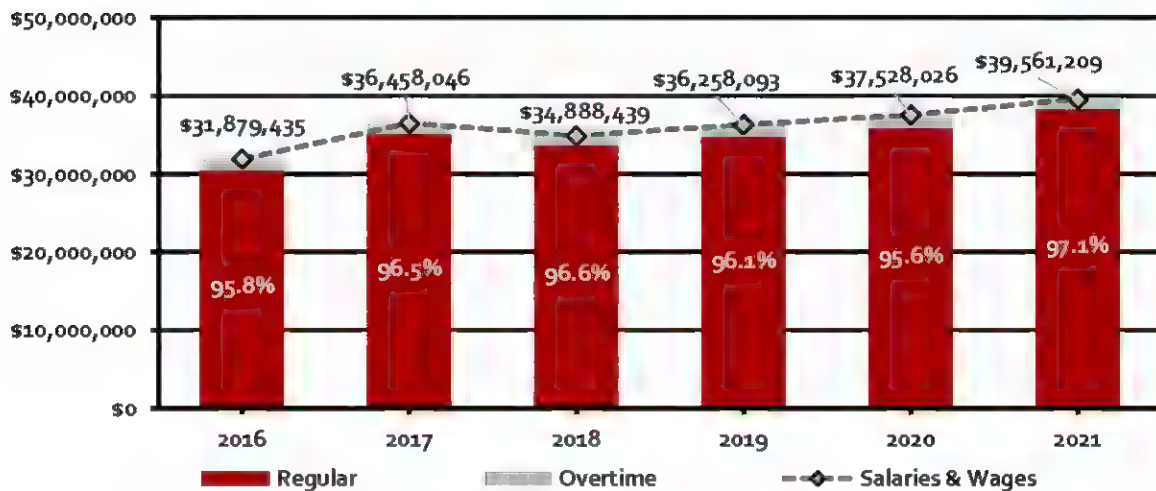
- Personnel Services**—total costs, shown in the following figure, have increased from \$40.4 million in FY 16 to \$47.3 million by FY 20 for an increase of 16.9% over the period, which represents an average annual increase of approximately 4%. This increase has resulted from the addition of FTE according to department records as well as normal increases in wages and benefits. The impact of adding FTE is discussed further below. Benefits have averaged 20.3% of total compensation, while salaries and wages have averaged 79.7% from FY 16–20.

Figure 60. Personnel Services Expense (FY 16–20 Actual; FY 21 Adopted)



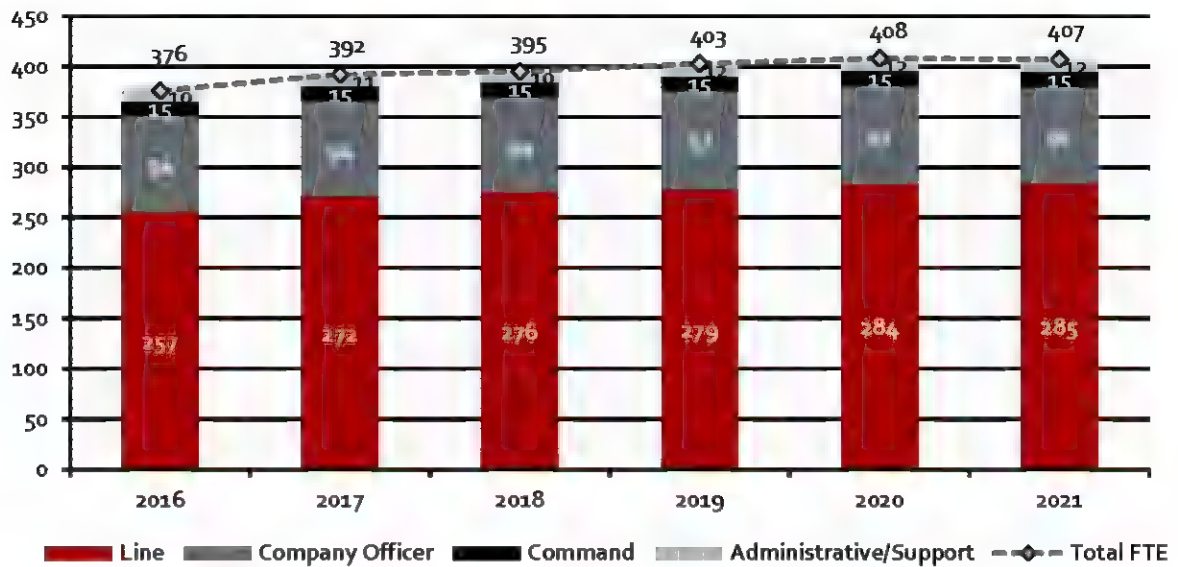
- Overtime costs (sick/vacation and other operational coverage) as a percentage of salaries/wages, and shown in the following figure, averaged 4.1%, while the salaries/wages line increased from \$31.88 million to \$37.53 million or an average of approximately 4.2% per year. This rate of increase is driven by an increase in FTE as well as regular wage and benefit increases authorized by the City Council as part of the annual budget process.

Figure 61. Salary/Wage Components (FY 16–20 Actual; FY 21 Adopted)



- For purposes of this discussion, all non-uniformed clerical, inspector, logistical, maintenance, and other support type positions are grouped together as administrative/support positions, while uniformed positions assigned to administrative roles are considered operational since they are certified and capable of acting in operational roles. Line positions are those providing traditional fire/rescue and EMS services. Line positions are firefighters, regardless of EMS certification, company officers are Lieutenants and Captains, while Command staff positions are uniformed officer positions above the company officer.
- The following figure shows budgeted, full-time staff count (FTE) by major category, which has increased from 376 FTE in FY 16 to 408 FTE in FY 20. This net increase of 32 FTE is driven by the addition of 27 firefighter and 3 Captain positions in the Fire Suppression division. One Captain was deleted from an administrative role, and two support positions were added, a Fire Protection Engineer and a Mechanic. The impact of these position changes needs to be taken into account to determine how much of the annual increase is due to regular wage and benefit changes.
- It should be noted that these represent actual filled positions and not total authorized positions. The number of total authorized positions increased in FY 20 from 406 to 409 with the addition of three safety captains. Fluctuations indicate the change in actual employee counts as people are hired and leave the organization.

Figure 62. Full-Time Fire Department Staff Count by Major Category (FY 16–21)



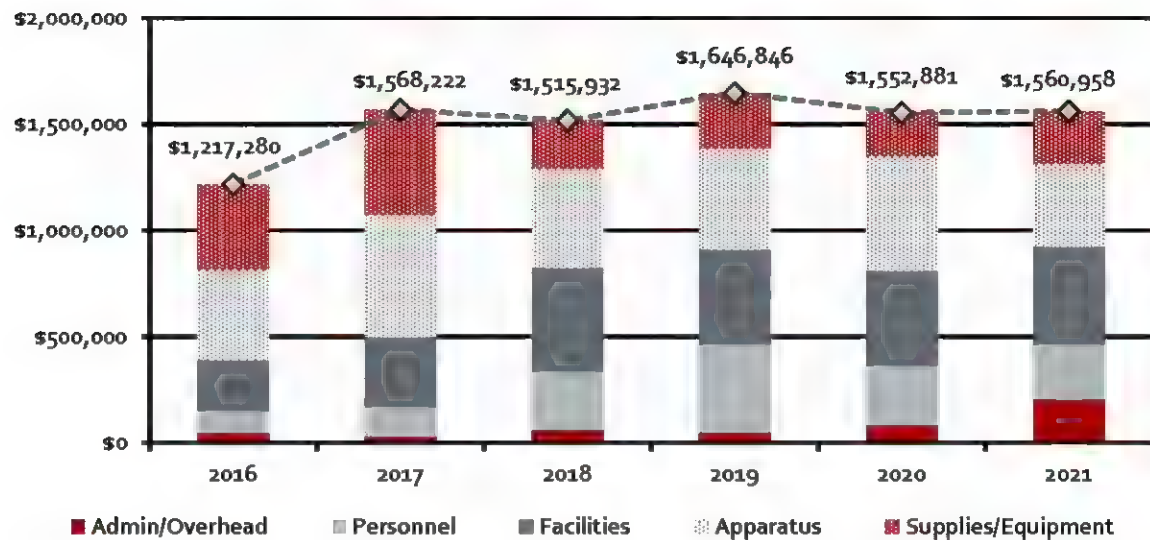
- Using FY 20 salary and benefit amounts for the various positions that have been added and/or deleted between FY 16 and FY 20, the following figure shows the approximate net total impact ("New Position Adjustment") that the addition or deletion of the positions discussed above has on the FY 20 adjusted budget.
- The total FY 20 adjustment due to staffing changes in salaries/wages for these positions is approximately \$2.89 million (a reduction of \$2.77 million in regular wages and a reduction of \$114,000 in overtime based on an average overtime amount of 4.1% of regular wages) while benefits are \$554,000 less. Subtracting the net cost of the added/deleted positions from the FY 20 actual Personnel Services line items leaves \$33.1 million and \$9.17 million, respectively, as revised totals for FY 20 wage and benefit totals. Therefore, the average annual increase in regular wages and benefits between FY 16 and FY 20 is approximately 2.04% and 1.8%, respectively.

Figure 63. Net Impact of FTE Added/Deleted on FY 20 Adjusted Personnel Services Budget

Expense	2016 Actual	2020 Actual	New Position Adjustment	2020 Revised	Average Annual Increase
Personnel Services	40,421,720	47,256,803	3,440,082	43,816,721	
Salaries & Wages	31,879,435	37,528,026	2,885,677	34,642,349	
Regular	30,530,077	35,874,685	2,772,024	33,102,661	2.04%
Overtime	1,349,358	1,653,341	113,653	1,539,688	
Benefits	8,542,285	9,728,777	554,405	9,174,372	1.80%

- **Ordinary Maintenance Expenses**—as shown in the following figure, after increasing approximately \$350,000 between FY 16 and FY 17, have remained relatively static, averaging just under \$1.57 million annually between FY 17 and FY 20.

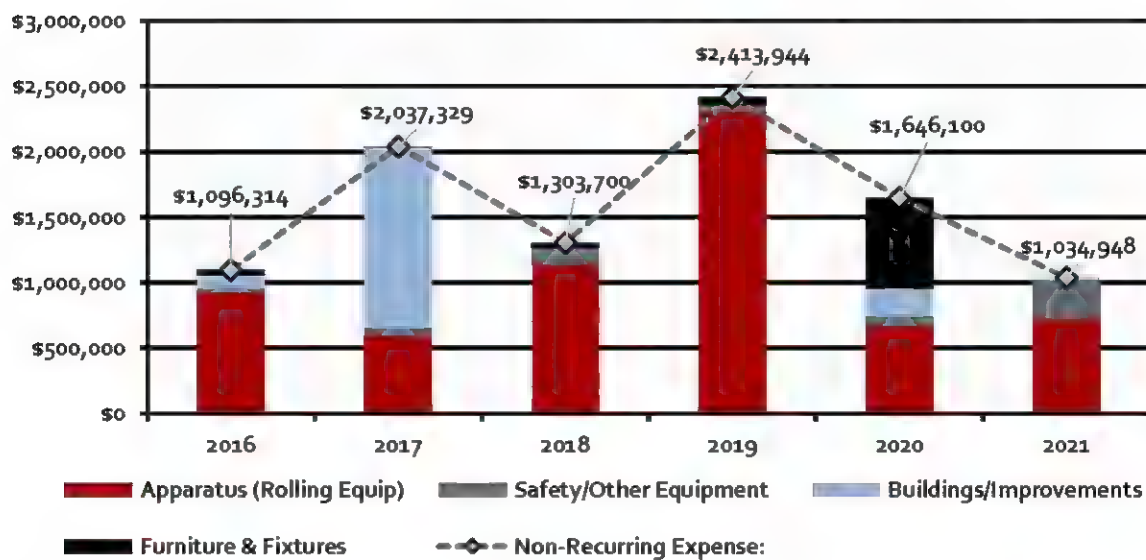
**Figure 64. Ordinary Maintenance Expense by Major Category
(FY 16–20 Actual; FY 21 Adopted)**



- **Administrative/Overhead**—although fluctuating year-to-year, have generally increased in a linear manner at an average annual rate of 14.6% between FY 16 and FY 20 before jumping significantly from \$86,000 in FY 20 to \$208,000 as adopted in FY 21. This increase is driven primarily by increases in consulting (\$76,000), hired services (\$15,200), and other charges/expenditures (\$34,000).
- **Personnel**—increased significantly between FY 16 and FY 19 as costs were incurred due to onboarding costs of additional Fire Suppression division FTE as discussed previously. These costs included recruit schools, uniforms, and Personal Protective Equipment (PPE), and other associated costs. Without factoring out these onboarding costs, the average annual increase between FY 16 and FY 20 is 28.6%. Costs between FY 20 and FY 21 as adopted are relatively flat, averaging close to \$280,000.
- **Facilities**—increased significantly between FY 16 and FY 18 from \$240,000 to almost \$490,000 before leveling out and fluctuating around an annual average of approximately \$460,000.
- **Apparatus**—including fuel, these costs have remained relatively stable, fluctuating around an average annual expenditure of \$496,000.
- **Supplies/Equipment**—averaged \$450,000 from FY 16 through FY 17, followed by a reduction of almost \$270,000. Between FY 17 and FY 20, this category has remained relatively stable, fluctuating around an average annual expenditure of approximately \$230,000.

Non-recurring expenses have been dominated by apparatus acquisition and have varied from a low of \$1.1 million in FY 16 to a high of \$2.4 million in FY 19. The following figure shows capital expenditures by category, with the dominant and variable impact of apparatus acquisition on the overall budget clearly seen. Vehicle/apparatus replacement and other major capital costs are generally accomplished within the city CIP budget but have been included in the analysis here to provide a fuller picture of Worcester Fire Department costs and comprise the vast majority of capital expenditures related to the Worcester Fire Department. As mentioned above, debt service costs related to fire department CIP projects are not shown in the analysis but should also be considered. The department has a strong long-range capital apparatus replacement plan which is in line with industry standards; however, this plan is subject to review and approval during the annual city CIP process.

Figure 65. Capital Expenses by Category (FY 16–20 Actual; FY 21 Adopted)

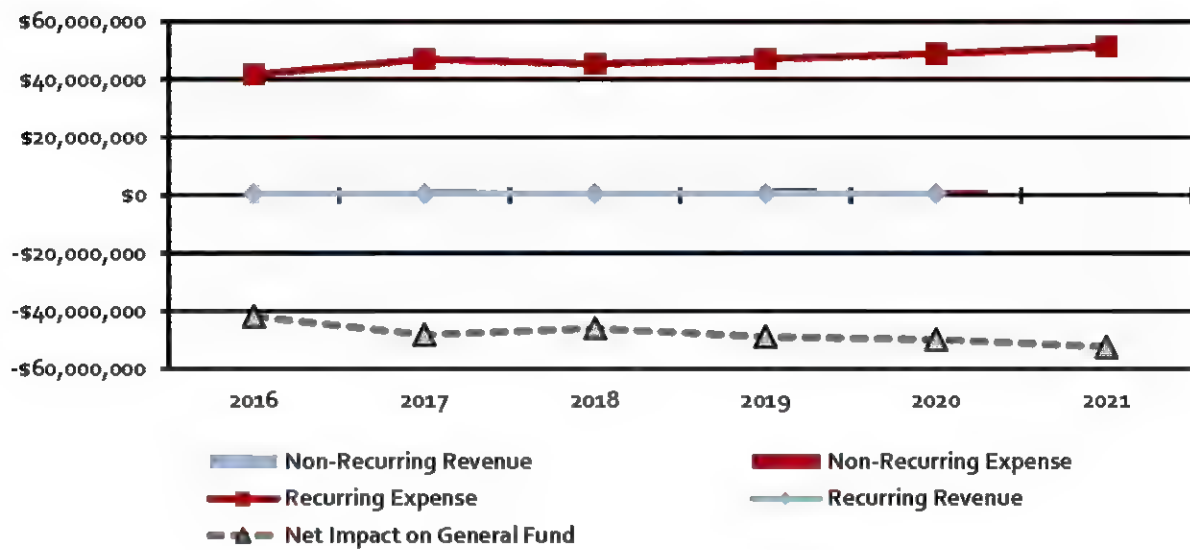


Net Impact on City General Fund

As mentioned, the fire department revenue and expenditure budgets are housed primarily within the city's General and CIP Funds but have a significant impact on the General Fund, particularly when CIP expenditures are considered. And, although fire department-related debt service is not shown here since it is part of overall city debt, the impact is even greater. The following figure shows total program-specific revenues (from all sources) and expenses from FY 16 actual through FY 21 adopted and the net impact on the General Fund.

Recurring expenditures have risen from \$41.6 million in FY 16 to \$48.8 million by FY 20, while department-specific recurring revenues are relatively insignificant and have remained generally static, averaging approximately \$530,000 annually. Non-recurring revenue is not significant, and non-recurring expenses average less than \$1.6 million annually. The net annual impact on the General Fund has risen from \$41.9 million in FY 16 to \$49.9 million in FY 20 and is projected at \$52.4 million in the FY 21 adopted budget. This gap has grown at an annual rate of approximately 4.5% between FY 16 and FY 20, driven largely by personnel costs. The city will need to monitor this trend and balance this increasing demand on GF revenues against other programs in the General Fund, particularly as it considers improvements in fire and rescue service levels.

Figure 66. Net Fire Department Impact on General Fund (FY 16–20 Actual; FY 21 Adopted)



Status Quo Projection

ESCI evaluated the historical information provided by staff to prepare a status quo expenditure forecast for the Worcester Fire Department. Revenue has remained relatively static, fluctuating around an annual average of \$530,000, and it is not anticipated to increase appreciably. Further, it is relatively minor compared to expenditures required to operate Worcester Fire Department, so it is not considered further in the status quo forecast. The forecast relies on trends previously developed through the historical review period along with forecast information available from the city when available to understand potential anomalies due to personnel changes, apparatus acquisitions, and other major events. Certain assumptions were made about various expenditure components and are outlined below. It should be noted that the model uses a straight-line annual increase for each of the five years in the projection for most items unless otherwise noted. Year-to-year fluctuation in each expenditure component is much more likely, but historical trends suggest that most changes are generally linear over an extended time frame. However, beyond five years, the use of an average annual increase based upon historical trending is highly speculative and should be monitored closely. The status quo projection assumes no change to service level and can be compared against the differential cost of various service level enhancements presented later in the section on decision unit costing and projection.

Expense Assumptions

The expense assumptions used in the Worcester Fire Department forecast are described in the following figure. The capital expenses represent an estimate based upon past CIP spending estimates. Major expenditure categories are discussed below, but for each category, the average annual rates of increase forecast and starting points may differ by program and fund as observed in the historical analysis. Individual program/fund rates of increase will impact the department totals in each category.

Figure 67. Worcester Fire Department Expenditure Forecast Assumptions (FY 22–26)

Expense Source	Assumptions
Personnel Services	The department has both historically added staff and increased total compensation to recruit and retain well-trained professional firefighters. The average annual rate of increase in PS costs has been 2.04% after removing the estimated impact of adding FTE. After adjusting for several additions and deletions, which resulted in a reduction in the adjusted FY 20 compensation costs, the average annual wage and benefit increases between FY 16 and FY 20 were 2.04% and 1.8%, respectively. The forecast uses the FY 21 adopted wages and benefits figures as a starting point for the projection and uses historical increases for each from FY 22–26. Overtime is anticipated to grow proportionately with regular wages and is maintained at the historical average of 4.1% of regular wages for the period FY 22–26.

Expense Source	Assumptions
Ordinary Maintenance (OM) Administrative/Overhead	The historical average annual increase of 14.6% from FY 16–FY 20; jump in FY 21 adopted based upon added consulting and other costs (approx. \$100 K) which are likely one-time; forecast uses FY 21 less \$100,000 (or \$110,000) as base with 14.6% annual increase.
OM-Personnel	Historical expenditures from FY 16–20 increased at 28.6% annually as a significant number of FTE were added (26 FF positions through FY 19); costs have come down significantly by FY 21. The U.S. Department of Labor reports an average New England Region consumer price index of approximately 2% for the four-year period 2016–2020. Although significantly lower following the COVID-19 pandemic, ESCI believes this rate will return during the forecast period and may even go higher based upon recent events. The forecast assumes annual projected inflation rate of 2% using the FY 21 figures as a basis for the projection. ⁴³
OM-Facilities	FY 16–FY 18 major increase after which spending leveled out to an average annual amount of \$462,000; forecast uses FY 21 as base with 4.5% annual increase based upon construction cost increase estimates cited in Zarenski (2019), who states that non-residential construction costs are estimated to have increased at 4–5% over the past five years and are expected to continue increasing at that rate. ⁴⁴
OM-Apparatus	FY 16–FY 20 costs have fluctuated around an annual average of \$496,000; forecast uses \$500,000 as the base with a 2% annual increase.
OM-Supplies/Equipment	Historical expenditures averaged \$450,000 between FY 16 and FY 17, after which they significantly decreased to an average annual expenditure of \$230,000; forecast uses FY 21 as the base with a 2% annual increase.
Capital- Buildings/Improvements	Forecast uses historical average as basis applied in FY 22 with 4.5% annual increase in subsequent years based upon construction cost increase estimates cited in Zarenski (2019). ⁴⁵

⁴³ <https://www.bls.gov/charts/consumer-price-index/consumer-price-index-by-category.htm>.

⁴⁴ Zarenski, Ed (2019); *Construction Cost Inflation-Commentary 2019*, in *Construction Analytics Economics Behind the Headlines*; see <https://edzarenski.com/2018/02/15/inflation-in-construction-2019-what-should-you-carry/>.

⁴⁵ Zarenski, Ed (2019); *Construction Cost Inflation-Commentary 2019*, in *Construction Analytics Economics Behind the Headlines*; see <https://edzarenski.com/2018/02/15/inflation-in-construction-2019-what-should-you-carry/>.

Expense Source	Assumptions
Capital-Furniture&Fixtures	Forecast uses historical average as basis applied in FY 22 with 2% annual increase in subsequent years based upon historical inflation costs as outlined above.
Capital-Apparatus	Forecast uses historical average as basis applied in FY 22 with 6.75% annual increase in subsequent years based upon historical average annual increases in Worcester Fire Department engine and ladder truck purchases.
Capital-Safety/Other Equipment	Forecast uses historical average as basis applied in FY 22 with 2% annual increase in subsequent years based upon historical inflation costs as outlined above.

The following figure is the status quo recurring expenditure forecast (average annual capital expense assumed recurring for the purposes of the forecast) for the Worcester Fire Department for FY 21 as adopted through the FY 26 forecast.

Figure 68. Worcester Fire Department Expenditure Forecast (FY 22–FY 26)

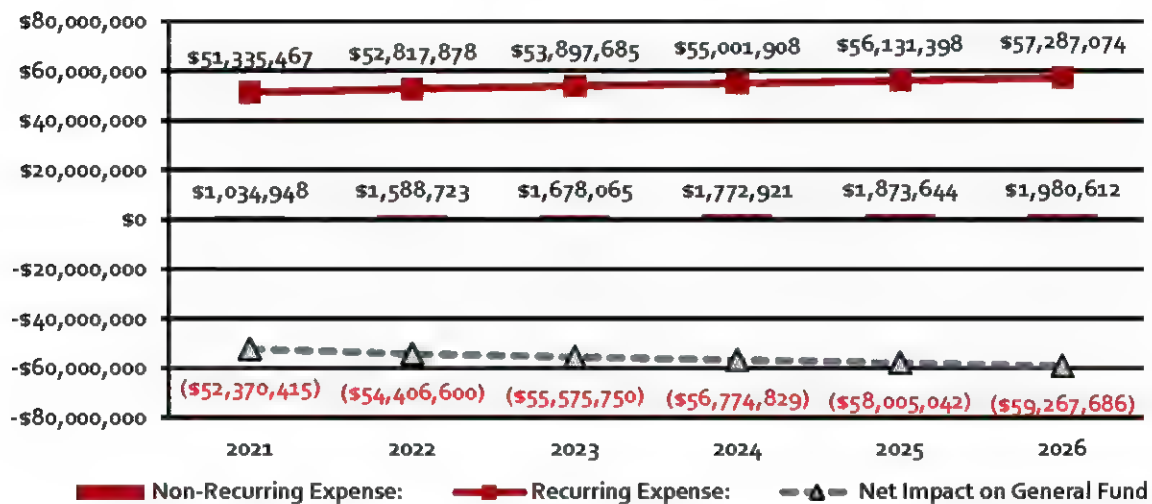
Expense	2021 Adopted	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast
Personnel Services	49,774,509	51,196,612	52,216,070	53,255,876	54,316,436	55,398,166
Salaries & Wages	39,561,209	40,799,473	41,631,782	42,481,071	43,347,684	44,231,977
Regular	38,409,033	39,192,577	39,992,106	40,807,945	41,640,427	42,489,892
Overtime	1,152,176	1,606,896	1,639,676	1,673,126	1,707,258	1,742,086
Benefits	10,213,300	10,397,139	10,584,288	10,774,805	10,968,752	11,166,189
Ordinary Maintenance	1,560,958	1,621,265	1,681,615	1,746,033	1,814,962	1,888,908
Admin/Overhead	208,563	126,060	144,465	165,557	189,728	217,428
Personnel	256,166	261,289	266,515	271,845	277,282	282,828
Facilities	460,896	481,636	503,310	525,959	549,627	574,360
Apparatus	388,000	500,000	510,000	520,200	530,604	541,216
Supplies/Equip	247,333	252,280	257,325	262,472	267,721	273,076
Recurring Exp:	51,335,467	52,817,878	53,897,685	55,001,908	56,131,398	57,287,074
Bldgs/Improv	14,320	284,337	297,132	310,503	324,475	339,077
Furn & Fixtures	0	136,086	138,807	141,584	144,415	147,304
Apparatus	731,628	1,062,313	1,134,019	1,210,566	1,292,279	1,379,508
Equipment	289,000	105,987	108,107	110,269	112,474	114,724
Non-Recurring Exp:	1,034,948	1,588,723	1,678,065	1,772,921	1,873,644	1,980,612
TOTAL EXPENSE:	\$52,370,415	\$54,406,600	\$55,575,750	\$56,774,829	\$58,005,042	\$59,267,686

Status Quo Forecast

The following figure shows total forecast recurring expenses (red line), forecast non-recurring expense (red bars), which can also be considered as recurring for purposes of the forecast, and net impact on the city General Fund (dotted grey line) for the forecast period FY 22–26. The forecast assumes no major changes in service level or operational configuration but does assume that the department will continue to increase total compensation as it has historically to attract and retain quality professionals.

Fire department-specific revenues will continue to be minor relative to total expenses, and expenditure increases will continue to be driven primarily by personnel costs. It is anticipated that the expenditure forecast could be used to gauge funding needs and used to assess the impacts of adding various decision units to enhance services, as discussed elsewhere in the study.

Figure 6g. Projected Worcester Fire Department Status Quo Net Impact on General Fund (FY 22–26 Forecast)



Financial Basis for Cost Projections

Most revenues and recurring expenditures, as well as minor non-recurring expenditures, comprising the total funding and cost of operating the fire department, are found in the City of Worcester General Fund. However, major capital facility construction projects and the largest equipment expenditures are accounted for in city Capital Improvement Funds which include bond proceeds and related revenues. Employee benefits are accounted for in a separate budget managed by the Human Resources Department. The city operates on a July 1 to June 30 fiscal year and uses a modified accrual basis with a “current financial resources focus” for fund accounting. A detailed composite review of historical revenue and expense for the department has been provided elsewhere in this study.

To estimate the future costs of any service level enhancement opportunities, it is first necessary to understand current year (Fiscal Year 2021) estimated costs for various decision unit components such as firefighter salary/benefits, onboarding costs, apparatus and equipment costs, and fire station construction and operating costs. Depending upon when these components may be added to the system, the FY 21 costs can be escalated based upon known or anticipated increases due to such influences as projected inflation for each component, City Council authorized pay increases, rising benefit costs, or some combination of factors.

Policy decisions regarding the adoption of any enhancements designed to improve service level are generally evaluated based upon projected initial and recurring cost versus the benefit provided. To understand the future costs of any enhancement, it is important to evaluate improvements in terms of decision units. A decision unit in the case of this Worcester Fire Department Master Plan can be considered a career-staffed engine, ladder or rescue company, shift District Chief, or an operating fire station with various staffed units. These decision units are comprised of components such as personnel with various associated initial and recurring costs, capital apparatus and facility acquisition, and recurring capital operating costs.

The following discussion uses actual or estimated Worcester Fire Department FY 21 costs, to the extent they were available, as a basis for costing of various decision unit components whose costs can then be escalated to that point in time when they may be added to the system. In other words, if the city determines that it needs to add an engine company to its operation in three years, the following FY 21 personnel, capital, and operating costs will serve as a basis for the addition of that unit were it to be added in FY 21. The escalation factors for the various components of that decision unit, as estimated from various sources, will then be applied to show the future cost at the point in time the department wishes to add that unit.

Fiscal Year 2021 Personnel Costs

Salary and benefit information for uniformed (operational) positions discussed in the following section was provided by the Fire and Human Resources departments for FY 21. The next figure provides the average annualized salary, benefits, and the total compensation costs for various decision unit positions, including Firefighter (regardless of EMS certification level), Lieutenant, Captain, and District Fire Chief. It is anticipated that additional, career-staffed suppression apparatus (engines, rescues, ladder trucks, and ambulances) would require some combination of the Captain and Fire Rescue Officer (Firefighter/Paramedic and Firefighter/EMT) positions.

The department does not have a formal Driver/Engineer classification, and the modeling assumes that someone with the required knowledge, skills, and abilities in the Firefighter classification would fulfill that role at the average annual compensation shown below. Most firefighters carry various levels of EMS and other certifications, and all positions in this classification have been averaged to develop the typical cost of this position in the following figure.

Figure 70. Annual Salary/Estimated Benefits Various Worcester Fire Department Uniformed Positions, FY

21			
Position	Average Annual Salary	Average Benefits	Avg. Total Compensation
Firefighter	\$ 87,982	\$ 22,470	\$ 110,452
Lieutenant	\$ 112,462	\$ 28,723	\$ 141,185
Captain	\$ 119,981	\$ 30,643	\$ 150,625
District Fire Chief	\$ 137,005	\$ 34,991	\$ 171,995

While it might be more appropriate to utilize entry-level compensation figures for additional Firefighter positions added on various units, using the average for the position will give a better “worst-case” cost scenario so that recommended improvements do not end up costing more than originally projected. Since there is no formal, promoted driver/engineer position, it is assumed that anyone assigned to that role would be a more experienced, higher-paid, Firefighter.

When adding positions, it is also important to include first-year onboarding costs along with the recurring cost of each new position. These costs generally vary from department to department but typically include such items as background checks/polygraphs, physicals based upon the NFPA 1582 firefighter standard, recruit school costs, uniforms, SCBA facepieces, Personal Protective Equipment or Turnout Gear, and may include radio/technology packages or other items. For purposes of this study, an estimated onboarding cost of \$7,500 was used for FY 21. After the initial year, these costs would not continue with the added position, and the only recurring costs associated would be the total annual compensation. However, it is also understood that the department’s annual operating costs (the Personnel category of Ordinary Maintenance as discussed) over time would increase due to added PPE replacement, training, and other associated employee costs.

An additional factor must be considered when evaluating the potential cost of adding positions. As with any other city employee, firefighters receive time off for various reasons such as vacation, sick, and funeral leave, among others. The Worcester Fire Department has determined minimum staffing requirements for various response units based upon risk and response protocols to emergency incidents. These minimum daily staffing needs require that when any firefighter is on leave, and daily staffing drops below the minimum, his or her position must be covered by another firefighter. This leave coverage required to maintain minimum daily staffing is termed the "relief factor." Based upon historical leave accruals and actual usage, the Worcester Fire Department relief factor goal is approximately 1.21.

The current four platoon shift staffing schedule means that for every minimum daily riding position on an apparatus, four FTE are required before considering any leave time (1 FTE x 4 shifts or platoons). The relief factor of 1.21 applied to each riding position means that 4.84 FTE are required to maintain that position and meet minimum staffing requirements. For the purposes of the projections provided for the addition of units, partial FTE are used to indicate the additional cost of covering leave time. This additional cost could either be accounted for with increased overtime or with the hiring of additional FTE as the level of need dictates. In other words, if one shift position is added to the system, 4.84 FTE are added; one for each shift and 0.84 FTE to cover the relief factor.

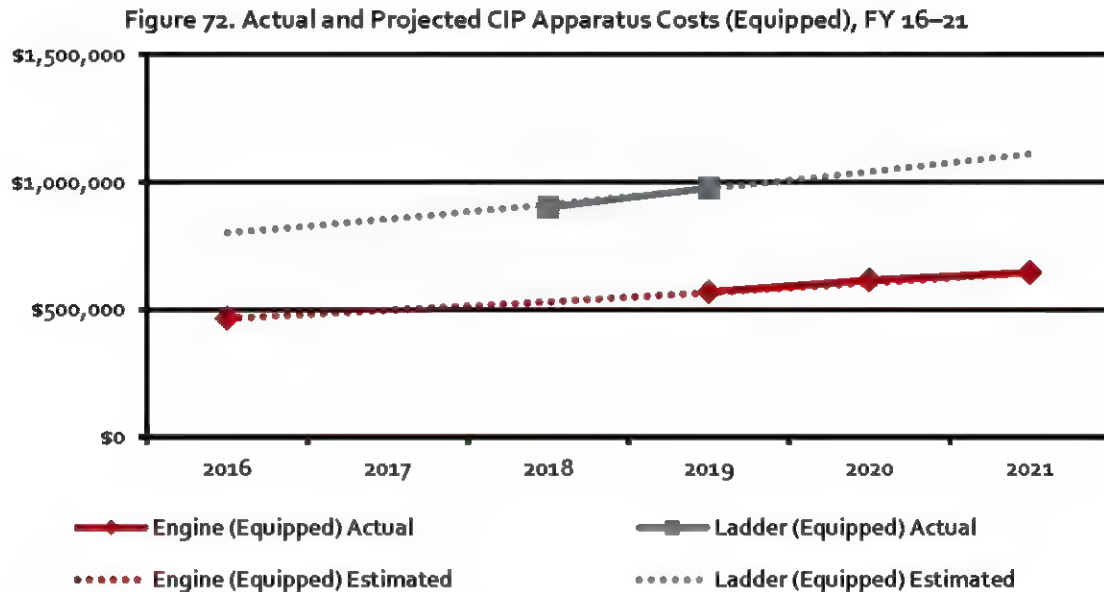
Fiscal Year 2021 Capital Apparatus/Equipment Costs

The next figure identifies FY 21 apparatus costs based upon the current Worcester Fire Department specifications for each apparatus class. Included in the total is the estimated cost to equip each type of vehicle. The following figure illustrates the first-year capital costs only and does not consider annual or recurring operating costs such as fuel, oil, and routine maintenance costs (parts and labor). To build the most accurate cost of adding each type of apparatus, these recurring costs would need to be considered for future years. The department has developed a comprehensive annual apparatus replacement program whose costs are based upon life expectancy and usage for each vehicle class. This is an industry standard practice and should incorporate an annual inflation factor.

Figure 71. Apparatus Costs (Equipped), FY 21

Class	Cost
Aerial Platform	1,500,000
Ladder Truck	1,100,000
Pumper	645,000
Heavy Rescue	780,000
SUV	40,383

Since apparatus in various classes are not purchased every year, FY 21 estimates for ladder trucks and engines and annual inflationary costs for these two classes based upon actual Worcester Fire Department purchases were developed using CIP data. The following figure shows CIP budgetary figures in solid symbols for both ladder truck and engine purchases in the year budgeted. The two dotted lines represent linear projections of costs using budget figures. The average annual cost increase for each class was then determined and used to develop an FY 21 cost. In each case, the average annual increase is 6.75% based upon a standard Worcester Fire Department specification. This increase is then also applied to potential future purchases through FY 26.



Fiscal Year 2021 Facility Capital/Operating Costs

The last category of costs considered as part of any potential future service level upgrade is those costs associated with fire station construction, including both initial construction and annual operating costs. Land costs will vary considerably depending upon many factors, such as market condition, developer proffers, environmental, and other factors. Therefore, land costs are generally not included in the estimated costs of any notional new fire stations.

Worcester Fire Department is in the early stages of replacing the South Division fire station and has developed an estimated construction cost of \$16 million using commercial construction cost estimates by square foot.⁴⁶ Since a detailed design and full costs have not yet been developed, this rough estimate was used as a starting point to develop an FY 21 estimated cost of constructing a replacement fire station for purposes of this decision unit analysis. Although funding for this new station has not yet been identified, estimated costs of \$17.44 million shown in the following figure include design, construction, and FF&E costs. Design costs are estimated at 7% of construction costs, while FF&E costs are estimated at 2% of total costs. The forecast assumes that future fire stations will generally be built using the same design, and costs will, therefore, be based upon a standardized floor plan with the pricing differential being due to inflation of materials and labor costs.

Figure 73. Estimated FY 21 Worcester Fire Department Fire Station Construction Costs

Category	Cost
Land	Varies
A&E Fees ¹	\$1,120,000
Construction ²	\$16,000,000
FF&E ³	\$320,000
Total	\$17,440,000
Station Operating⁴	\$110,000

¹Estimated at 7% of total construction cost

²Estimated by staff using persq ft construction cost

³Estimated at 2% of total construction cost

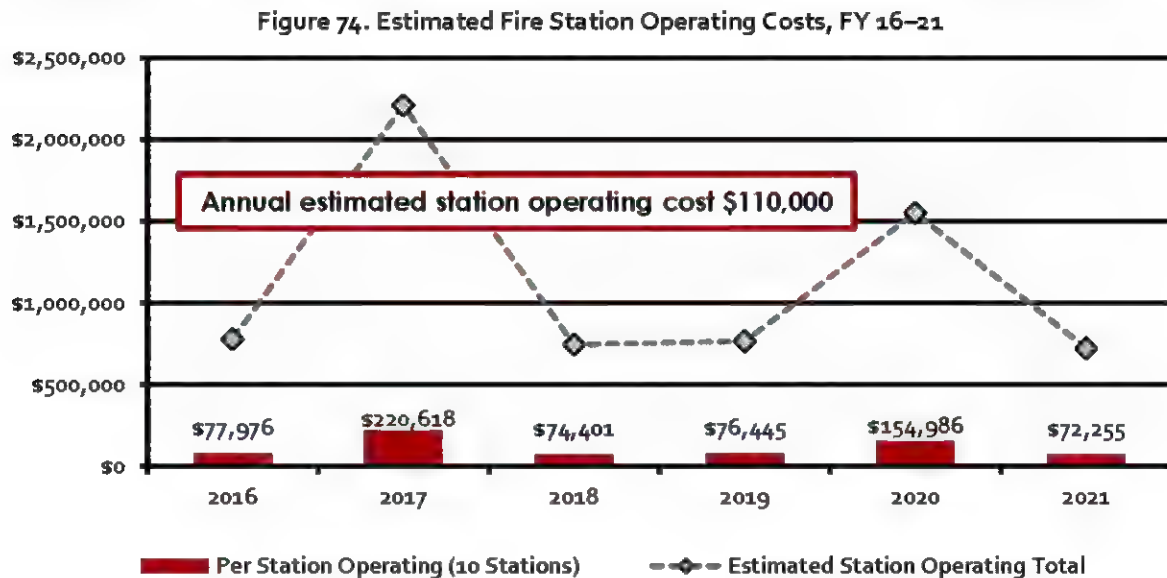
⁴Estimate based upon departmental and city overhead expenses

After construction costs are considered, there is an annual operating cost for a new facility that will be comprised of multiple components. Many jurisdictions provide and charge facilities maintenance, utilities, and related operating costs for various fire department and other facilities on a square footage basis as an interfund charge. Fire departments will also budget for some routine station operating costs, such as various O&M needs. Typical operating costs generally budgeted for by departments include printing/copying, telephone and internet, laundry and janitorial, office supplies, minor equipment, books and subscriptions, and other operating supplies. Costs either paid directly or to other internal service departments may include utilities, routine maintenance and janitorial, grounds maintenance, refuse and pest control services, among others.

For purposes of this projection, Worcester Fire Department station operating costs were determined by adding the average annual cost of Facilities (\$462,000) and Supplies/Equipment (\$229,000) in the Ordinary Maintenance category of recurring expense to the non-recurring Buildings/Improvements (\$284,000) and Furniture & Fixtures (\$136,000) average annual costs in Capital for a total of \$1.11 million. This total divided by ten stations gives an estimated annual station operating cost of \$110,000.

⁴⁶ Personal Communication, Deputy Chief Dyer, 5/5/21.

Various typical facility-related operating costs for the Worcester Fire Department, as mentioned in the preceding paragraph, have been grouped and are shown in the following figure both in aggregate and on a per station basis (assuming uniform costs distributed across ten fire stations). Between FY 16 and FY 20, total estimated station operating costs, while fluctuating significantly due to building capital costs, have averaged approximately \$1.11 million annually. Based upon a uniform distribution across ten fire stations, this gives an annual fire station operating cost estimated at approximately \$110,000. For projection purposes, an average annual operating cost of \$110,000 for FY 21 has been used.



Fiscal Year 21 Decision Unit Staffing Costs

To provide relief staffing (sick/vacation and other overtime coverage), the Worcester Fire Department should plan and budget for 4.84 personnel to cover each required seat on an apparatus that is staffed 24/7 using four shifts or platoons. In other words, the department will apply a relief factor of 1.21 to each new FTE added. This is shown in the single resource table in the following figure (the uppermost table), which also shows the total number of personnel needed by rank and compensation for an engine, ladder, or rescue company.

ESCI recommends that Worcester Fire Department staff engine or ladder companies with a minimum of four firefighters on each of four shifts; three firefighters, at least one of whom is qualified to operate the apparatus, and a company officer. In the projections shown in the following figure, the officer is a Lieutenant in all cases. It is understood that Worcester Fire Department may wish to add a Captain on one or more of the shifts. In that case, the recurring cost for the company would be somewhat higher (approximately \$46,000 in FY 21 if the Lieutenant is replaced with a Captain on all four shifts) and can be estimated using the single resources cost projections. A heavy rescue truck should be staffed with five firefighters per shift, so total staffing would include 4.84 additional firefighters versus an engine or ladder company.

Each 24-hour seat or riding position requires 4.84 budgeted FTE to ensure minimum daily staffing (one FTE for each of four shifts plus an additional 0.84 FTE as a relief factor). The FY 21 cost per rank needed for one FTE is shown along with the total cost for all personnel required in each rank for all four shifts and relief coverage to maintain the minimum staffing.

Figure 75. Estimated Decision Unit Staffing Costs, FY 21

Single Resource			
Position	FTE	Unit Cost	Total Cost ¹
Firefighter	4.84	\$ 110,452	\$ 534,589
Lieutenant	4.84	\$ 141,185	\$ 683,336
Captain	4.84	\$ 150,625	\$ 729,023
District Fire Chief	4.84	\$ 171,995	\$ 832,458

4-Person Engine/Ladder Company			
Position	FTE	Unit Cost	Total Cost ¹
Firefighter	14.52	\$ 110,452	\$ 1,603,768
Lieutenant	4.84	\$ 141,185	\$ 683,336
Crew Total	19.36		\$ 2,287,104

Heavy Rescue Company			
Position	FTE	Unit Cost	Total Cost ¹
Firefighter	19.36	\$ 110,452	\$ 2,138,358
Lieutenant	4.84	\$ 141,185	\$ 683,336
Crew Total	24.20		\$ 2,821,694

¹Total cost and FTE count provides for assumed relief factor of 1.21

Decision Unit Cost Projection

Total compensation costs have been projected to increase annually at 3.6% (based upon historical trends). The following figure shows FTE count, average wages, and overtime by select Worcester Fire Department positions in both FY 16 and FY 20. The average annual wage increase by position is shown in the far-right-hand column. Average annual increases have varied from a low of 4% for the Firefighter position to a high of 5% for the Lieutenant position. A weighted average (based upon total FTE totals in each class) for these positions is 4.21%. Regular wages have averaged just under 96% of total wages, which reduces the average annual increase to 4%. Since benefits have historically averaged 20.3% of total compensation and have increased an average of 1.8% annually, FTE costs are projected to increase at an aggregate of 3.6% annually. Annual operating costs have been projected to increase by 2% annually based upon a four-year average for the New England Region CPI-U, prior to the onset of the COVID-19 pandemic, as reported by the U.S. Bureau of Labor Statistics.⁴⁷ It is anticipated that this rate of inflation will continue once the nation recovers from the pandemic and the economy returns to pre-pandemic conditions. Recent economic data suggest that the inflation rate may grow higher than the pre-COVID-19 four-year average.

Figure 76. Actual Average Annual Wage Increases by Select Worcester Fire Department Position, FY 16 to FY 20

Operational Position	2016			2020			Avg Annual Change (%)
	FTE	Wages	Overtime	FTE	Wages	Overtime	Wages
District Fire Chief	12	107,915	6,726	13	130,605	10,250	4.90%
Fire Captain	24	98,212	5,423	28	115,256	9,521	4.10%
Fire Lieutenant	71	88,218	4,527	74	107,107	5,783	5.00%
Firefighter	284	72,264	2,261	301	84,598	3,471	4.00%

Using the estimated FY 21 decision unit staffing costs provided as a starting point, and making various assumptions about cost increases over time, decision unit costs are projected through FY 26 in the following figure.

Historical apparatus and equipment costs have been observed by ESCI to increase at approximately 4% annually as an industry standard. However, actual average annual increases for Worcester Fire Department apparatus have been higher at 6.75%; therefore, this higher figure is used in the projection. According to Zarenski (2019), non-residential construction costs are estimated to have increased at 4–5% over the past five years and are expected to continue increasing at that rate.⁴⁸ Construction costs can be as high as three times the Consumer Price Index and are heavily dependent upon labor and material costs as well as construction demand and backlog. Import tariffs on building materials such as steel and other commodities may have an increasing impact as well.

⁴⁷ <https://www.bls.gov/charts/consumer-price-index/consumer-price-index-by-category.htm>.

⁴⁸ Zarenski, Ed (2019); *Construction Cost Inflation-Commentary 2019*, in *Construction Analytics Economics Behind the Headlines*; see <https://edzarenski.com/2018/02/15/inflation-in-construction-2019-what-should-you-carry/>.

Figure 77. Projected Decision Unit Costs, FY 21 through FY 26

Decision Unit	Personnel Recurring Costs ¹					
	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026
Firefighter	\$ 534,589	\$ 553,745	\$ 573,587	\$ 594,139	\$ 615,429	\$ 637,481
Lieutenant	\$ 683,336	\$ 707,821	\$ 733,184	\$ 759,455	\$ 786,668	\$ 814,856
Captain	\$ 729,023	\$ 755,145	\$ 782,204	\$ 810,232	\$ 839,264	\$ 869,336
District Fire Chief	\$ 832,458	\$ 862,286	\$ 893,184	\$ 925,189	\$ 958,340	\$ 992,679
Engine/Ladder	\$2,287,104	\$2,369,056	\$2,453,944	\$2,541,873	\$2,632,954	\$2,727,298
Rescue Company	\$2,821,694	\$2,922,801	\$3,027,530	\$3,136,013	\$3,248,382	\$3,364,778

Decision Unit	Personnel On-Boarding Costs ²					
	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026
Firefighter	\$ 36,300	\$ 37,026	\$ 37,767	\$ 38,522	\$ 39,292	\$ 40,078
Lieutenant	\$ 36,300	\$ 37,026	\$ 37,767	\$ 38,522	\$ 39,292	\$ 40,078
Captain	\$ 36,300	\$ 37,026	\$ 37,767	\$ 38,522	\$ 39,292	\$ 40,078
District Fire Chief	\$ 36,300	\$ 37,026	\$ 37,767	\$ 38,522	\$ 39,292	\$ 40,078
Engine/Ladder	\$145,200	\$148,104	\$151,066	\$154,087	\$157,169	\$160,313
Rescue Company	\$181,500	\$185,130	\$188,833	\$192,609	\$196,461	\$200,391

Decision Unit	Capital Apparatus (Equipped) Cost ³					
	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026
Engine	\$ 645,000	\$ 670,800	\$ 697,632	\$ 725,537	\$ 754,559	\$ 784,741
Aerial (Platform)	\$ 1,500,000	\$ 1,560,000	\$ 1,622,400	\$ 1,687,296	\$ 1,754,788	\$ 1,824,979
Aerial (Ladder)	\$ 1,100,000	\$ 1,144,000	\$ 1,189,760	\$ 1,237,350	\$ 1,286,844	\$ 1,338,318
Rescue	\$ 780,000	\$ 811,200	\$ 843,648	\$ 877,394	\$ 912,490	\$ 948,989
Command Unit	\$ 40,383	\$ 41,998	\$ 43,678	\$ 45,425	\$ 47,242	\$ 49,132

Decision Unit	Capital Facility (Initial and Recurring) Cost ^{2,4}					
	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026
Construction	\$17,440,000	\$18,224,800	\$19,044,916	\$19,901,937	\$20,797,524	\$21,733,413
Operating	\$ 110,000	\$ 112,200	\$ 114,444	\$ 116,733	\$ 119,068	\$ 121,449

¹ Increase based on projected annual comp increase of 3.6%; includes sufficient FTE to cover 1.21 relief factor

² Increase based on pre-COVID19 8-year historical New England Region CPI-U avg of approx. 2% as of Dec, 2020

³ Cost increase based upon Worcester FD average annual increase of 6.75%

⁴ Cost increase based upon historical non-residential construction cost increase over last four years of 4-5%

The first table in the figure shows total annual staff costs, including relief factor, for single resources (for example, one 24/7 Firefighter position which requires 4.84 FTE in FY 21 costs \$534,589), 4-person engine/ladder, and 5-person heavy rescue companies as projected from FY 21 through FY 26.

The second table shows what the one-time onboarding costs would be to hire the number of firefighters needed to fully staff each unit or individual position in any given year over the period. For example, if 19.36 FTE were added in FY 21 to staff a 4-person engine company, it would cost \$2,287,104 in personnel costs plus \$145,200 in onboarding costs for a total of \$2,432,304 the first year. Personnel costs would then increase at 3.6% annually so that the personnel costs for the same 19.36 firefighters on that engine company would be \$2,727,298 by FY 26. If a 5-person heavy rescue company were to be added, the personnel costs would need to be escalated by 4.84 additional FTE whenever it was planned. The four-person company would have three firefighters, at least one of whom was certified to operate the apparatus, and one company officer assigned per shift (Lieutenant in this case or Captain on one or more shifts at an additional cost).

The following two tables in the figure show the capital costs; the first table shows the equipped apparatus cost throughout the projection period, while the second table shows the facility construction and operating costs through FY 26. Using the projected costs, a standardized station, excluding estimated land costs, would cost approximately \$17.44 million to construct in FY 21 with an annual operating cost of \$110,000. That same station, if constructed in FY 26, would cost approximately \$21.73 million and have an operating cost of \$121,449. Purchasing an equipped engine in FY 21 would cost \$645,000, while that same engine in FY 26 would cost \$784,741.

The projected figures for various decision unit components can be used as an approximate guide to determine the cost of implementing various potential enhancements as recommended in the study at whatever point over the next five years the city finds appropriate and is able to fund them. These costs would then be in addition to those shown in the status quo projection.

Management Components

To be effective, the management of a department needs to be based on a number of components. These include a clearly stated mission, a vision for the future, and the values or guiding principles. From these fundamental elements, the organization evaluates the environment it operates within, and establishes a series of strategic initiatives, goals, and objectives. These elements combine to form a Strategic Plan.

Mission

A mission statement is an explanation of the organization's reason for existence. The mission statement supports the vision and serves to communicate purpose and direction to employees, customers, and other stakeholders. The mission statement should answer the questions "What is our organization's purpose?" and "Why does our organization exist?" The Worcester Fire Department had a pending mission statement that was being reviewed by staff members at the time of ESCI's site visit. ESCI recommends that the Worcester Fire Department complete its review of the pending mission statement and adopt it.

An example of a mission statement for Nashua Fire Rescue in New Hampshire is provided as a demonstration to answer these questions.

Figure 78. Sample Mission Statement: Nashua Fire Rescue

To create a safe and vibrant community through risk reduction, preparedness, and a proactive all hazards response plan.

Vision

A vision statement establishes the ideal image that the organization wishes to achieve. The vision statement should answer the questions "Where are we headed?" and "If we achieved all strategic goals, what would we look like 10 years from now?" ESCI recommends that the Worcester Fire Department establish a vision statement that reflects the planned direction of the department.

A sample vision statement for the City of Winchester Fire and Rescue Department in Virginia is provided. The Winchester Fire and Rescue Department's Vision Statement is:

Figure 79. Sample Vision Statement: City of Winchester Fire and Rescue Department

Winchester Fire and Rescue Department strives to be a leader in combination Fire and Rescue Services.

Values

An organizational values statement includes the core principles that guide the organization and its culture. In a values-led organization, the values guide decision-making and establish a standard against which actions can be assessed. The values statement should answer the questions “What values should guide the operations of our organization?” and “What conduct should our employees uphold?” ESCI recommends that Worcester Fire Department adopt a values statement that includes the core principles that will guide the organization.

A sample organizational values statement from the Chesterfield County Fire and EMS Department in Virginia is provided below which clearly identifies the values that guide the operations of that organization.

Figure 8o. Sample Values: Chesterfield County Fire and EMS Department

In order to protect life, property and the environment, we recognize that "great service is provided by great people" who are guided by a set of principles and values. We will constantly strive to take care of each other and provide for the safety, health, and well-being of our members. We will promote teamwork in meeting our goals and encourage initiative in continuously improving our individual performance as well as the quality of both our external and internal services and programs. To be successful as an organization, we must listen and communicate honestly, accurately and in a timely manner to foster trust and understanding. Furthermore, we have an expectation that our members will conduct themselves in accordance with the department's organizational values:

We are dedicated to providing the highest quality of public safety services to the citizens and visitors of our country in a safe, effective, and timely manner.

We are compassionate to those we serve and each other.

We are honest in all of our interactions with others.

We have the highest sense of integrity to earn the trust and respect of our citizens and coworkers.

We have courage to do what is right for our community, the department, and our members.

We are accountable to our citizens, the department, and each other for our actions and for achieving the highest professional standards.

ESCI notes that just as the operations of a fire department are dynamic, so are the guiding principles for the organization. These components can change as the department and community change.

Julie Chakraverty recently wrote an article for Forbes.com titled *Company Vision and Values: Do They Still Matter?*⁴⁹ In this article, she cited a recent report from the World Economic Forum that found that a “sense of purpose” in work is the second most important criteria for millennials considering a job after salary. Ms. Chakraverty concluded that given that this generation will make up the majority of the workforce in coming years, it is not difficult to predict that if candidates for employment do not believe or support an organization’s mission, they will not accept a job offer. This can lead to recruitment challenges. Ms. Chakraverty’s research further suggested that employees aged between 45 and 54-years-old and 55 to 64-years-old—not uncommon age groups for management—were the least likely age groups to be able to recite their organizations’ mission and vision.

ESCI recommends that after the Worcester Fire Department adopts Mission, Vision, and Values Statements, the fire department further commits to reviewing and updating these statements as the fire department evolves to ensure that these management components accurately reflect the current organization and the service demand from the community.

Internal Communications Processes

Non-Emergency Communications

Internally, the Worcester Fire Department provides a variety of methods to communicate with staff members. The Department uses email, intranet, and written memorandums to distribute information within the organization.

Internal communications were repeatedly identified as a major deficiency within the Worcester Fire Department during both the member interviews and in the member survey. Members requested more engagement from the department leadership. Specifically, members would like to see more of the leadership and have time to talk with them personally on both a professional and personal level.

⁴⁹ <https://www.forbes.com/sites/voicesfromeurope/2018/03/28/company-vision-and-values-do-they-still-matter/#7755b77b217f>

There was universal frustration voiced over the number of initiatives launched over the last several years with a perceived shortage of background information to communicate “the why.” The consensus among those interviewed was that the communication chain in the department is broken, causing even the best of intended programs to fail, or be undermined due to a lack of explanation of the purpose, need, or vision. Examples cited include the concept of transitional attack (interpreted to be applied in all situations and enacted to eliminate the interior attack), large-diameter supply lines (bewildering due to the Worcester water system being very reliable), a commitment to maintaining four-person staffing on truck companies (perceived to have just been forgotten/ignored), and Blue Card Command (training not completed, but members using terminology on the street unfamiliar to others leading to confusion on the incident scene). Members also noted they rarely see a ranking member above their respective District Chief, and District Chiefs frequently roll out new initiatives under the auspice of “This is what *they* want us to do.” Senior Staff is only visible in the rank and file’s eyes when something is going wrong.

When asked in the survey what was the best method for communications within the Worcester Fire Department, the two most common responses were email and face-to-face communications. Many of the respondents felt that these two forms of communication were best used in tandem.

The leadership of the Worcester Fire Department reported to ESCI that they maintain an open-door policy that allows members of the fire department to talk to the Chiefs about anything at any time. While in concept this could be viewed as an effort to improve communications, special attention must be paid to make sure that this does not lead to Chain of Command violations.

Emergency Communications

Members of the Worcester Fire Department repeatedly voiced concerns about radio communications during ESCI’s site visit. They reported that the north District Chief and south District Chief had assigned fireground channels. The concern was that incoming crews could be potentially missing orders given by the first arriving District Chief, who may be on a different channel than the first arriving apparatus.

A second concern repeatedly and consistently voiced by members of the Worcester Fire Department to ESCI was also related to emergency communications. Members reported that it is common for fireground orders to be given to crews by a District Chief who is not on the scene. Apparatus is assigned to a division as well as one of the two District Chiefs. The District Chief will give an order to the apparatus assigned to his division because “they are my guys.” One officer stated that he received four different orders at a fire the week before ESCI’s visit. ESCI heard of similar scenarios in various meetings with firefighters across the city.

External Communications Processes

Externally, the Worcester Fire Department maintains a website to provide information to its customers, but it does not have a formal citizen feedback/input mechanism in place to receive necessary end-user feedback. The department uses Facebook (17,000 followers) and Twitter (10,500 followers) in an effort to communicate key information to its customers. Historically, successful fire departments have used a community newsletter to communicate with the citizens of their jurisdictions. Now, these same agencies have begun to transition to social media platforms as the customer base has begun to express an expectation of digital communication and in a more real-time environment.

ESCI recommends that the Worcester Fire Department continue to develop its social media presence in an effort to provide information to, and receive information from, its customers. It is also recommended that the Worcester Fire Department evaluate the use of a survey tool to collect performance feedback from those citizens who have used the services of the Worcester Fire Department. The gathering of information directly from these individuals will allow department and city leadership to key in on specific performance issues that allow for intervention in a timelier manner, as well as highlight those performance issues that customers indicate as being of high value.

Hiring Process

The Worcester Fire Department utilizes the Commonwealth's Civil Service process for hiring new firefighters. The Civil Service Unit of the Commonwealth administers all written tests. In the case of entry-level firefighters, this includes both written and physical ability tests. Civil Service then provides the Worcester Fire Department with a ranked score based on the established merit system.

Promotional Process

The promotional process for Lieutenant, Captain, and District Chief is conducted by the Commonwealth's Civil Service Unit through a standard examination administered statewide. Eligibility is based on time in grade only. There are no training or educational prerequisites required.

Health and Wellness Programs

Employee Assistance

The Collective Bargaining Agreement sets forth the following:

Bargaining unit employees shall be afforded the opportunity to participate in an Employee Assistance Program (EAP). The governing principles for such participation shall be volunteerism and strict confidentiality as to the fact of and all details of such participation. The Union and the Fire Chief jointly shall designate from the bargaining unit an individual to serve as Fire Department Employee Assistance Program liaison who shall assist unit employees regarding introduction to and participation in the EAP. The EAP liaison shall be granted release time during his/her scheduled work only with the approval of the Fire Chief for his/her designee, which approval shall not be withheld reasonably.

Safety Committee

The Collective Bargaining Agreement sets forth the following:

Effective upon the date of execution of this Agreement, there is established a joint safety committee consisting of a representative appointed by the City, a representative appointed by the union, and a neutral representative chosen by both sides. The parties will agree upon a procedure to choose a neutral representative if they fail to agree upon one. If the parties are unable to agree on such a procedure, then the Union and the City agree to use on an expedited basis the provisions of Schedule A Paragraph G 1 C arbitration to resolve the issue as to the identity of the neutral representative. Said committee shall meet at regular intervals to discuss safety issues raised by either party provided, however, that the Committee is empowered to make recommendations to the City regarding only mandatory subjects of bargaining as set forth in Chapter 150E of the General Laws and excluding manning and manpower subjects. The Committee will present its recommendations to the City Manager. The City Manager will implement recommendations adopted by a majority of the Committee provided, however, that any of such recommendations which require funding to implement must be implemented by the City Manager from an account which will be established by the City in the amount of \$25,000.00 annually. It is further agreed that the City will not be required to implement any recommendations of the Committee which require funding in excess of the \$25,000.00 annual appropriation as set forth above. It is further agreed that no appropriation pursuant to this paragraph will be required for items already addressed by the existing Collective Bargaining Agreement Provided that the Union has submitted to the Fire Department no later than January first of the fiscal year involved proposals for the full expenditure of the annual twenty-five thousand dollars (\$25,000.00) account as provided herein any portion of such amount remaining unexpended as of June 30 of that fiscal year will be included by the Employer in the immediately succeeding fiscal year safety fund account appropriation in addition to the new amount of twenty-five thousand dollars (\$25,000.00) to be appropriated to that account for such succeeding fiscal year.

Planning for Fire and Rescue Service Delivery

The Current Planning Process

Now more than any other time in the history of the United States, fire and emergency services agencies operate in a rapidly changing environment. Along with improved tools and technologies that are used to provide service, there is the increased regulation of activities, new risks to protect, and other challenges that can quickly catch the unwary off guard. Only through continuous internal and external environmental awareness and periodic course corrections can an organization stay on the leading edge.

In order to do the best job possible with available resources, organizations must focus on improving services while identifying programs or activities that may no longer serve their changing needs. Through planning, a fire department is able to establish a vision, create a framework within which decisions are made, and chart its course to the future. The quality and accuracy of the planning function determine the success of the organization.

To be truly effective, an emergency services agency must consider planning on four distinct levels:

Figure 81. Levels of Planning

Planning Level	Description
Tactical Planning	The development of strategies for potential emergency incidents.
Operational Planning	The organization of day-to-day activities, as primarily outlined by a department's standard operating guidelines and procedures. This includes the integration of the agency into other local, regional, or national response network.
Master Planning	Preparation for the long-term effectiveness of the agency as the operating environment changes over time.
Strategic Planning	The process of <i>identifying</i> an organization's mission, vision, and values <i>and prioritizing goals and objectives</i> for things that need to be accomplished in the near future.

Without effective planning, it is impossible for an organization to know when it is reaching milestones or providing exceptional services to its constituency. The National Fire Protection Association has established NFPA 1600: *Standard on Disaster/Emergency Management and Business Continuity/Continuity of Operations Programs* and NFPA 1201: *Standard for Providing Fire and Emergency Services to the Public*, as standards to assist fire departments in establishing and maintaining planning documents and conducting planning activities.

Tactical Planning Within the Organization

Beyond the fire station, the firefighter's emergency operational work environment is, more often than not, an unknown environment. Normally, a firefighter's first visit to a building is when the building is involved in a fire or another emergency. In the case of a fire, the internal environment is at its worst. Contrary to movie portrayals, visibility during a fire is at or near zero due to smoke. A lack of familiarity with a building can easily cause a firefighter to become disoriented or injured by an unfamiliar internal layout, or by equipment or other hazards that might be encountered.

It is critically important that firefighters and command staff have comprehensive, accurate information readily at hand to identify hazards, direct tactical operations, and use built-in fire-resistive features. This can only be accomplished by building familiarization tours, developing pre-fire plans, and conducting tactical exercises, either on-site or by tabletop simulation.

Pre-incident plans should be easy to use, quick reference tools for company officers and command staff. At a minimum, a pre-incident plan should include information such as:

- Building construction
- Occupant characteristics
- Incorporated fire protection systems
- Capabilities of public or industrial responding personnel
- Water supply
- Exposure factors
- Facility layouts

The Worcester Fire Department does have pre-plans that are available for reference from laptops while on scene. During the COVID-19 pandemic, firefighters were directed to cease field inspections, so there is now a need to set a schedule to make up for the missed inspections as well as to stay current with the inspections that need to be done.

Operational Planning Within the Organization

Operational planning includes establishing minimum staffing policies, standardized response plans or protocols, regional incident command planning, mutual and automatic aid planning (locally and regionally), resource identification and planning, and disaster planning.

The Worcester Fire Department must make it a priority to update its *Rules and Regulations* and its *Guidelines*. Each company should possess a predetermined assignment that is consistent with current industry standards and best practices prior to arriving on the scene. Each company should also have a thorough understanding of company assignments for other arriving units based upon the order of arriving or as directed by the incident commander.

Scene accountability must be maintained at all times using a system that prevents responders from entering an environment that could be Immediately Dangerous to Life or Health (IDLH). This includes accounting for each individual firefighter, their rank, position on the apparatus, company, and assignment on the fireground prior to engaging in suppression activities using a recognized accountability system. The Worcester Fire Department does not currently have a system that accomplishes this requirement. This lack of scene accountability is a fundamental element in the line of duty deaths Worcester Fire Department has experienced. Currently, the department is actively working to correct these issues; however, basic incident command training, such as the National Incident Management System (NIMS) Training provided online by the Federal Emergency Management Agency (FEMA), must be accomplished by all members of the department. Additional training through tabletop exercises and multicompartment drills are also recommended.

ESCI reviewed both the Worcester Fire Department's *Rules and Regulations* and its *Guidelines*.

Rules and Regulations

The following is the preamble to the *Rules and Regulations* of the Worcester Fire Department.

Figure 82. Preamble to the Rules and Regulations of the Worcester Fire Department

**AN ORDER PROMULGATING RULES AND
REGULATIONS OF THE WORCESTER
FIRE DEPARTMENT**

WHEREAS:

The city of Worcester has established the Worcester Fire Department under the provisions of Chapter 2 of the Revised Ordinances of 1951, as amended; and

WHEREAS:

The City of Worcester has recodified its Ordinances and is revising its practices and procedures; and

WHEREAS:

Section 21 of the Fire Department's Administrative Ordinances provides for the City Manager to promulgate rules and regulations for the government of the Fire Department and its members, subject to the approval of the City Council.

NOW, THEREFORE, I, Francis J. McGrath, by virtue of the authority vested in me as City Manager do hereby promulgate the following rules and regulations dated October 24, 1972.

Promulgated at City Hall
October 24, 1972


City Manager

Although promulgated almost half a decade ago in 1972, ESCI was told by city and fire department leadership that these Rules and Regulations are still to this day relied upon to make decisions.

ESCI's review of the Rules and Regulations revealed a series of sections that are outdated, not in compliance with industry standards or best practices, or in direct conflict with current Worcester Fire Department *Guidelines* or current practices. A sampling of these inconsistencies is provided below. This list does not include all of the outdated or conflicting sections.

Chapter IV, Sections 6 and 7 state that the Deputy Chiefs shall investigate the cause of all fires or explosions to which they respond and that they shall make a complete report on forms that are furnished for such purposes. Current practices within the Worcester Fire Department do not assign investigation responsibly to the Deputy Chiefs; furthermore, forms are no longer furnished for such purposes.

Figure 83. Rules and Regulations Chapter VI, Sections 6 and 7

SECTION 6

Deputy Chiefs shall investigate into the cause of all fires or explosions to which they respond. If it appears that such fire or explosion is of suspicious origin, or the result of a violation of law, he shall immediately notify the Chief and also the Police Department.

SECTION 7

Deputy Chiefs shall make a complete report of every fire or emergency to which they respond on forms furnished for such purpose.

Chapter VI, Section 3 requires members of the Worcester Fire Department to provide themselves with the following listed personal protective equipment which no longer complies with industry standards or best practices.

Figure 84. Rules and Regulations Chapter VII, Section 3

SECTION 3

Every member of the department shall provide himself with the regulation fire helmet, regulation fire boots with hard leather or steel innersoles, and steel toe cap, regulation rubber coat and work gloves.

Chapter X, Section 40 requires that the following individuals be called in on a Third Alarm. ESCI's research revealed that Chief Edward F. Hacket retired 42 years ago in 1979 and passed away 13 years ago in 2008.

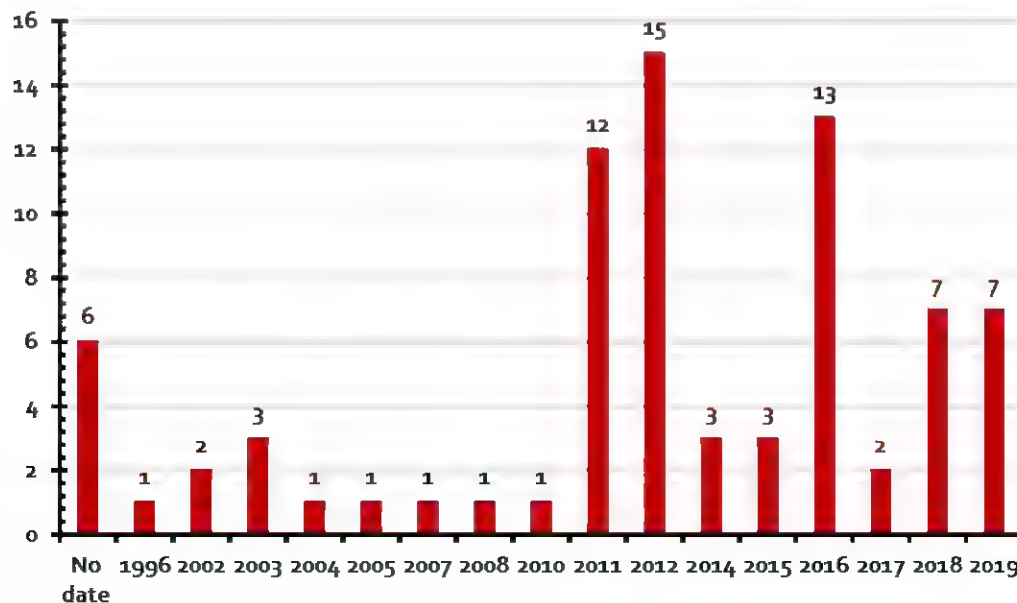
Figure 85. Rules and Regulations Chapter X, Section 40

- THIRD ALARM**
1. Chief Edward F. Hackett
 2. Next due in working shift of Chief Officers (or alternates) consisting of a Deputy Chief and North and South District Chiefs.
 3. Chief Mechanic - Paul Marin (or alternate)
 4. One of the following office personnel in order.
 Frank A. Reno
 Donald F. Gribbons
 William F. Barrell
 5. Robert Farmer of the Civil Defense
 6. Notify the Norton Company Fire Department that a multiple alarm is in progress.

Guidelines

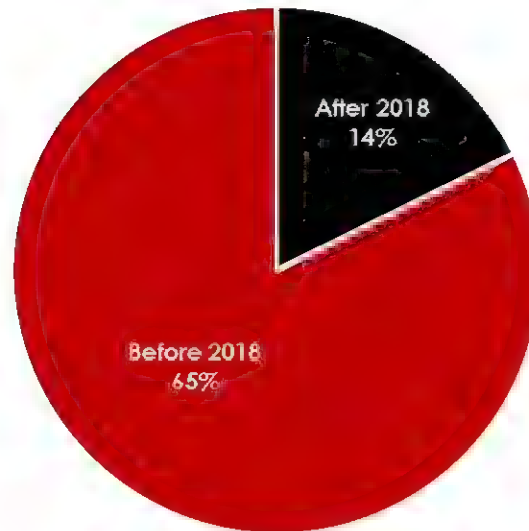
ESCI recommends that fire departments review their guidelines to assure compliance with industry standards and best practices no less than every three years. The following figure shows how many policies were approved or reviewed and the year in which that occurred. The oldest Guideline that is still in effect was approved 25 years ago in 1996. Six policies do not include a date of issue.

Figure 86. Worcester Guideline Date of Approval/Revision



ESCI noted that 65% of the current Worcester Guidelines were written before 2018.

Figure 87. Age of Worcester Guidelines



ESCI suggests the Worcester Fire Department set a review schedule that provides for every policy to be reviewed and updated no less than every three years. This review should also include an annual gap analysis to identify the need for new rules and regulations. The Worcester Fire Department would further benefit from having a review of all rules and regulations conducted by an independent third-party to ensure compliance with industry standards and best practices.

The development and implementation of updated rules, regulations, and guidelines will enable the Worcester Fire Department to move forward in an organized and effective manner. In the absence of these documents, an organization will tend to operate in a random and generally ineffective manner. ESCI notes that the recommendations made in the National Institute for Occupational Safety and Health (NIOSH) Line of Duty Death Reports specific to the firefighter line of duty deaths in Worcester should be a focus of these policy updates.

As part of developing a system of policies to govern the operations of the Worcester Fire Department, ESCI recommends using an online platform, such as Target Solutions®, as a mechanism to inform individuals when new policies and procedures are published. This system allows each employee to receive the new documents personally and acknowledge receipt with an electronic timestamp. The system also enables supervisors to require each employee to answer questions specific to the document's content and ensure the employee receives the desired information.

Long-Range Master Planning Efforts

Master or long-range planning is preparation for the Worcester Fire Department's future service delivery effectiveness based on projections of the future service delivery environment. This long-range master plan focuses on the big picture perspective, distant future needs of the City of Worcester, and is particularly important in an agency experiencing growth. Fire service organizations that engage in a long-range master planning process will be able to utilize this valuable information to answer the following three questions:

- Where is the organization today?
- Where will the organization need to be in the future?
- How will this organization get there?

The City of Worcester contracted with ESCI to develop this Master Plan. This master plan will give the Worcester Fire Department a clear idea of where it is today based on an evaluation of current conditions. The master plan will also project the future needs of the Worcester Fire Department, along with providing the strategies to meet them. A master plan is designed to provide a view of the organization in a 15-year time frame.

It is critical that, once finalized, the Worcester City Council adopt the recommended Master Plan or at least a variation of the recommended Master Plan to show formal support for the future direction of the Worcester Fire Department.

Strategic Planning

Strategic planning supports the organization's mission and sets and prioritizes short-term internal goals. A Strategic Plan typically involves a three-to-five-year planning window. Community involvement in the process is critical as the Strategic Plan should be customer-oriented while accomplishing the following:

- Development of a mission statement giving careful attention to the services currently provided and which logically can be provided in the future.
- Development of a vision statement of the agency moving forward.
- Establish the values of the members of the agency.
- Identification of the strengths, weaknesses, opportunities, and challenges of the agency.
- Determination of the community's service priorities.
- Understanding the community's expectations of the agency.
- Establishment of realistic goals and objectives for the future.
- Identification of implementation tasks for each objective.
- Definition of service outcomes in the form of measurable performance objectives and targets.

Once the Fire Service Master Plan is developed and adopted, the list of recommendations, guidance for changes, and new initiatives will provide direction for developing a new Strategic Plan. This is the most effective way to prioritize and plan for the implementation of the master plan's findings. The City of Worcester has already contracted with ESCI to facilitate the Strategic Plan.

The Strategic Planning process will result in a three-to-five-year work plan, intended to guide the work effort of the entire organization toward a common set of goals and objectives. The process should include representation from every major interest group in the organization. Each firefighter should feel that their interests are represented by someone in attendance on the planning team.

Upon completion of the Strategic Plan, it should be formally adopted by the Worcester City Council.

Capital Assets and Capital Improvement Programs

Facilities


The Worcester Fire Department operates ten fire stations. Appropriately designed facilities provide safe living amenities for personnel and house appropriate assets for deployment in order to provide timely service.

ESCI visited each of the ten fire stations in February 2021. In general, the Worcester fire stations were in poor condition, with only the two newest stations being in good condition. ESCI categorized the stations according to the following criteria:

Figure 88. Fire Station Condition Classifications

Excellent	Like new condition. No visible structural defects. The facility is clean and well maintained. Interior layout is conducive to function with no unnecessary impediments to the apparatus bays or offices. No significant defect history. Building design and construction match the building's purposes. Age is typically less than 10 years.
Good	The exterior has a good appearance with minor or no defects. Clean lines, good workflow design, and only minor wear of the building interior. Roof and apparatus apron are in good working order, absent any significant full-thickness cracks or crumbling of apron surface or visible roof patches or leaks. Building design and construction match the building's purposes. Age is typically less than 20 years.
Fair	The building appears to be structurally sound with a weathered appearance and minor to moderate non-structural defects. The interior condition shows normal wear and tear but flows effectively to the apparatus bay or offices. Mechanical systems are in working order. Building design and construction may not match the building's purposes well. Showing increasing age-related maintenance, but with no critical defects. Age is typically 30 years or more.
Poor	The building appears to be cosmetically weathered and worn with potentially structural defects, although not imminently dangerous or unsafe. Large, multiple full-thickness cracks and crumbling of concrete on the apron may exist. The roof has evidence of leaking and/or multiple repairs. The interior is poorly maintained or showing signs of advanced deterioration with moderate to significant non-structural defects. Problematic age-related maintenance and/or major defects are evident. May not be well suited to its intended purpose. Age is typically greater than 40 years.

Figure 8g. Worcester Fire Stations and Facilities

Facility	Picture	Address	Date of Construction	Apparatus Housed	Condition
Station 2		180 Southbridge St.	1959	Engine 2 Engine 13 Ladder 3 Car 4	Poor
Station 3 <i>Fire Headquarters Training Division Maintenance Shop</i>		141 Grove St.	1954	Engine 3 Engine 16 Ladder 2 Car 3	Poor
Station 4		424 Park Ave.	1979	Engine 4 Ladder 7	Poor
Station 5		40 Webster St.	2001	Engine 5 Ladder 4 Special Operations 1	Good
Station 6		266 Franklin St.	2008	Engine 6 Engine 12 Ladder 1 Rescue 1 Incident Safety Officer	Good
Station 7		745 Grafton St.	1986	Engine 7	Poor
Station 8		19 Burncoat St.	1966	Engine 8	Poor
Station 9		1067 Pleasant St.	1924	Engine 9	Poor
Station 11		438 W Boylston St.	1974	Engine 11 Ladder 6	Poor
Station 15		80 McKeon Rd.	1994	Engine 15 Ladder 5	Fair

Across the city, most of the Worcester Fire Department stations are functioning as they were originally built with only minor modifications. All except for the three newest stations (Stations 5, 6, and 15) are in dire need of significant updates to accommodate modern fire apparatus, which are heavier, larger, and taller than apparatus of a generation or more ago.

ESCI found the living conditions within all except for the three newest Worcester fire stations to be in poor to extremely poor condition. In many cases, firefighters have brought in their own furniture and worked with their crews to perform minor renovations as approved by the fire department to make the stations habitable. ESCI observed all of the following:

- A firefighter bunkroom with holes that were open to the outside allows rain, wind, and snow into the room.
- A bay that floods when it rains, so firefighters are required to move their turnout gear to “higher ground” if they do not want to have wet gear for their entire 24-hour shift.
- Rodent and insect issues.
- Outdated, cramped, and generally unpleasant kitchens, bunkrooms, and bathrooms.

During ESCI’s interviews with the Worcester firefighters, the poor condition of the stations was consistently brought up as a detriment to morale. Multiple firefighters stated on multiple occasions that it made it difficult to want to go to work in the morning, knowing that the next 24 hours would be spent in such conditions.

Automatic Sprinkler Protection

The majority of the Worcester fire stations are limited in their smoke detection, fire protection, and alarm notification capabilities. Only three of the fire stations (Stations 5, 6, and 15) have sprinklers, leaving the other 70% of the fire stations unprotected. NFPA 1: *Fire Code* requires that “New buildings housing emergency fire, rescue, or ambulance services shall be protected throughout by approved supervised automatic sprinkler systems.” The requirement for sprinkler protection not only protects the emergency services personnel occupying the facility but also reduces the risk of disrupting the provision of emergency services to the community as a result of a fire. While not required by the code, ESCI recommends that the Worcester Fire Department install fire sprinkler systems in all of its existing fire stations as they are rebuilt for the safety of the firefighters who work in the stations as well as to demonstrate to the community the importance of automatic fire sprinkler systems.

Back-In Bays

Stations 2, 3, 8, 9, and 15 have “back-in” bays, which are considered to be a serious safety concern as many firefighter injuries and accidents occur when emergency vehicles are being backed into the fire station. ESCI notes that all stations use “back-in” procedures; however, drive-through bays are the recommended configuration. For future stations, Worcester should consider a design that allows for drive-through bays that are large enough to accommodate all frontline and reserve apparatus.

Cancer Prevention Engineering

The occupation of firefighter is recognized as one where those working in the industry are more likely to be diagnosed with cancer than the general public. The danger for firefighters does not stop when the fire is extinguished but returns to the fire stations through their gear, equipment, and vehicles that were exposed to, and contaminated by, smoke or other vapors. When contaminated gear and equipment are returned to the station via their respective response apparatus, the potential for cross-contamination occurs.

Within the Worcester Fire Department, there are cancer prevention policies in place. Firefighters have been provided with training, a second set of personal protective equipment, wipes, and protocols for both cancer prevention and decontamination. An additional preventative measure that could be taken by the Worcester Fire Department is to limit/reduce firefighter exposure to toxic products of combustion which occur *after the fire* (i.e. off-gassing). As existing stations are reconstructed, the Worcester Fire Department should take steps to store turnout gear in a well-ventilated room to prevent additional firefighter exposure to off-gassing of chemicals absorbed into turnout gear during a fire. To that end, the Worcester Fire Department should also relocate any current fitness areas that are housed within apparatus bays to locations where firefighters can exercise without exposure to the toxic products of combustion.

Fire Headquarters/Training Division/Maintenance Shop/Station 3

The Worcester Fire Department Headquarters, Training Division, Maintenance Shop, and Station 3 are all co-located at 141 Grove Street. Fire Headquarters is inadequate in size and design to manage a fire department of this size.

The Training Division includes a double classroom that has adequate seating for training of up to 30 members, however, the administrative area can only accommodate a staff of five. The Training Division is in need of technology upgrades of all of its audio-visual equipment.

The Maintenance Shop ceilings are so low that many of Worcester's tilt-cab trucks have to be repaired outside. This makes repairs particularly challenging during inclement weather. Storage, drainage, and technology within the Maintenance Shop are also all inadequate.

Facility Security

Fire departments have typically been considered to be open environments where residents and visitors from the community have been allowed access to any part of a fire station with very few limitations. Unfortunately, the current social environment requires emergency services providers to implement specific security measures limiting and controlling access to fire department facilities. This is driven by the need to protect firefighters, expensive equipment, and sensitive data from inadvertently being accessed by individuals desiring to harm the community.

ESCI recommends that the Worcester Fire Department implement video monitoring and recording at exterior entry points to ensure increased levels of security and awareness as to who is entering or attempting to enter Worcester Fire Department facilities. The department should also evaluate the implementation of an access card system that identifies each fire department member accessing facilities. This evaluation should also include the ability of Worcester Fire Department leadership to change access of a staff member immediately from a central location based upon a member's employment status or operational concern.

Fire Station Renovation and Construction

The Worcester Fire Department infrastructure will require significant financial investment in the coming years. Eight of the ten fire stations are more than 30 years old. The remaining two fire stations are 13 and 20 years old and require scheduled maintenance and repairs before they fall into the same state of disrepair as the rest of the stations.

ESCI further notes that many of the Worcester fire stations have outlived their useful life and that some of these stations are no longer located in the optimal location to meet the current service demands in the city. Consideration should be given to relocating some of these stations rather than renovating them. GIS Models for Fire Station Optimization are included within the *Opportunities and Recommendations* section of this plan.

Apparatus

The Worcester Fire Department maintains a sizeable fleet of fire suppression vehicles. The following figure provides an inventory of fire apparatus, configuration, and condition, ordered by apparatus number.

Figure 90. Worcester Fire Department Apparatus

Radio Call Sign	Apparatus Type	Chassis Manufacturer	Apparatus Manufacturer	Year	Condition	Status (Frontline Reserve)
Engine 2	Engine	E-One	E-One	2018	Excellent	Frontline
Engine 3	Engine	E-One	E-One	2020	Excellent	Frontline
Engine 4	Engine	E-One	E-One	2003	Immediate Replacement	Frontline
Engine 5	Engine	E-One	E-One	2002	Immediate Replacement	Frontline
Engine 6	Engine	E-One	E-One	2013	Excellent	Frontline
Engine 7	Engine	E-One	E-One	2012	Excellent	Frontline
Engine 8	Engine	E-One	E-One	2010	Good	Frontline
Engine 9	Engine	E-One	E-One	2016	Excellent	Frontline
Engine 11	Engine	Seagrave	Seagrave	2007	Consider Replacement	Frontline
Engine 12	Engine	E-One	E-One	2017	Excellent	Frontline
Engine 13	Engine	Seagrave	Seagrave	2007	Good	Frontline
Engine 15	Engine	E-One	E-One	2016	Excellent	Frontline
Engine 16	Engine	E-One	E-One	2019	Excellent	Frontline
Engine 22	Engine	KME	KME	1997	Immediate Replacement	Reserve
Engine 25	Engine	KME	KME	1993	Immediate Replacement	Spare
Engine 26	Engine	KME	KME	1997	Immediate Replacement	Spare
Engine 27	Engine	KME	KME	1997	Immediate Replacement	Reserve
Ladder 1	Ladder Truck	E-One	E-One	2019	Excellent	Frontline
Ladder 2	Ladder Truck	Seagrave	Seagrave	2014	Excellent	Frontline
Ladder 3	Ladder Truck	Seagrave	Seagrave	2004	Consider Replacement	Frontline
Ladder 4	Ladder Truck	E-One	E-One	2019	Excellent	Frontline
Ladder 5	Ladder Truck	Smeal	Smeal	2011	Excellent	Frontline
Ladder 6	Ladder Truck	Smeal	Smeal	2006	Consider Replacement	Frontline
Ladder 7	Ladder Truck	Smeal	Smeal	2006	Consider Replacement	Frontline
Ladder 23	Ladder Truck	Sutphen	Sutphen	1995	Immediate Replacement	Spare
Ladder 24	Ladder Truck	E-One	E-One	1994	Immediate Replacement	Reserve
Rescue 1	Rescue	E-One	E-One	2017	Excellent	Frontline
Rescue 2	Rescue	E-One	E-One	2001	Immediate Replacement	Reserve
Scuba Truck	Scuba Truck	Ford	Ford	2008	Consider Replacement	Frontline
Special Operations 1	Heavy Rescue	Seagrave	Seagrave	2004	Consider Replacement	Frontline

ESCI observed the Worcester Fire Department's vehicles to be well maintained and generally in good condition. The City of Worcester has recently made significant investments into the Worcester Fire Department fleet, and from interviews with firefighters, the general impression of the fleet's condition is that it is very good. ESCI was impressed with the appearance and general condition of the department's apparatus, which is indicative of the agency's culture of pride and ownership.

ESCI evaluated the age of the Worcester Fire Department's fleet of apparatus, finding that the units range from a high of 37 years of age, which includes the department's reserve apparatus and utility vehicles, to a low of just two years. Nine of the department's 25 frontline apparatus are five or fewer years old. By averaging the total apparatus list, ESCI calculates an overall combined average of 11.4 years.

Apparatus Replacement

Fire apparatus are typically unique pieces of equipment, often very customized to operate efficiently in a narrowly defined mission. A pumper may be engineered such that the compartments fit specific equipment and tools, with virtually every space on the truck designated in advance for functionality. This same vehicle, with its specialized design, cannot be expected to function in a completely different capacity, such as a hazardous materials unit or a rescue squad. For this reason, a fire apparatus is very expensive and offers little flexibility in use and reassignment. Thus, communities across the country have sought to achieve the longest life span possible for these vehicles. From interviews conducted with firefighters, apparatus layout, multiple configurations of vehicle and compartment design, and a feeling that some apparatus are used for purposes that they were not designed for were common themes. Worcester has made tremendous progress over the last five years in updating and standardizing the fire department's fleet.

Unfortunately, no mechanical piece of equipment can be expected to last forever. As vehicles age, repairs tend to become more frequent, parts more difficult to obtain, and downtime for repair increases. Given the emergency mission that is so critical to the community, this factor of downtime is one of the most frequently identified reasons for apparatus replacement.

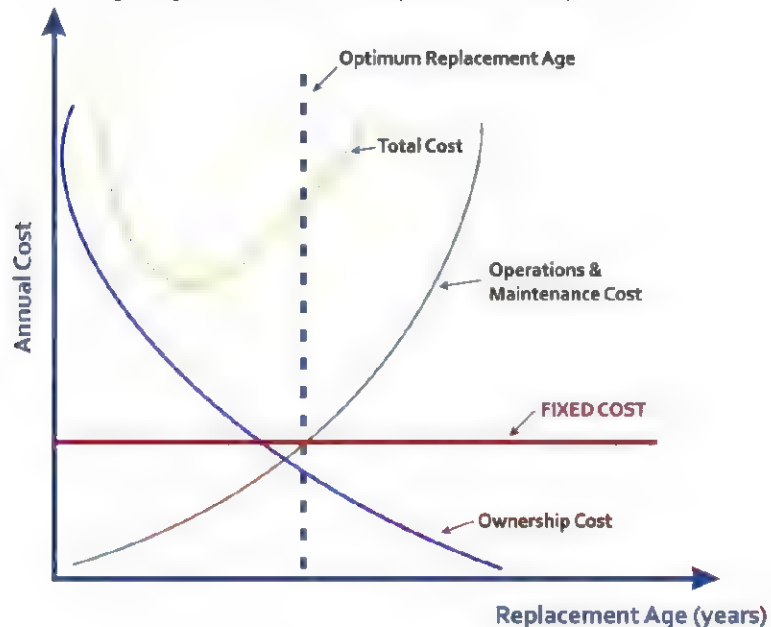
Because of the large expense of a fire apparatus, most communities find the need to plan for the cost of replacement. To properly do so, agencies often turn to the long-accepted practice of establishing a life cycle for the apparatus that results in a well-anticipated replacement date. Forward-thinking organizations then set aside incremental funds during the life of the vehicle so that replacement dollars are ready when needed.

NFPA 1901: *Standard for Automotive Fire Apparatus* is a nationally recognized industry standard for the design, maintenance, and operation of fire suppression apparatus. The issue of replacement cycles for various types of apparatus has been discussed in the committee that develops the standard for many years. In developing its latest edition, the committee calls for a life cycle of 12 years in frontline service and five years in reserve status for engines, and 15 years in frontline service and five years in reserve status for ladder trucks.

This does not mean that a fire engine cannot be effective as a frontline pumper beyond 12 years. A visit to many departments across the United States will prove that time and time again. Small, volunteer fire departments with only a hundred or so calls per year often get up to 25 years from a pumper, though the technology is admittedly not up to date. Likewise, busy downtown City fire stations in some urban communities move their engines out of frontline status in as little as eight years.

A conceptual model that may be used when a replacement cycle is considered is the Economic Theory of Vehicle Replacement. The theory states that as a vehicle ages, the cost of capital diminishes, and its operating cost increases. The combination of these two costs produces a total cost curve. The model suggests the optimal time to replace any piece of apparatus is when the operating cost begins to exceed the capital costs. This optimal time may not be a fixed point but rather a range over time. The flat spot at the bottom of the total curve in the following figure represents the replacement window.

Figure g1. Economic Theory of Vehicle Replacement



Shortening the replacement cycle to this window allows for an apparatus to be replaced at optimal savings to the department. If the department does not routinely replace equipment in a timely manner, the overall reduction in replacement spending can result in a quick increase in maintenance and repair expenditures. Officials who assume that deferring replacement purchases is a good tactic for balancing the budget must understand that two events may occur:

- Costs are transferred from the capital budget to the operating budget.
- Such deferral may increase overall fleet costs.

Regardless of its net effect on current apparatus costs, the deferral of replacement purchases unquestionably increases future replacement spending needs.

ESCI advises clients that the day that a new piece of fire apparatus is delivered, the agency should start to set funds aside for its replacement. Each piece of fire apparatus and the related support equipment has a predictable expected useful service life, based on a practical balance of use and maintenance cost. By analyzing age, projected service life, and replacement costs with an inflation factor, a replacement schedule can be established that looks farther into the future than simply the annual budget process enabling the agency to more effectively forecast future financial demands and plan for them.

ESCI recommends that the Worcester Fire Department review its current apparatus inventory as well as the apparatus life cycle and develop an Apparatus Replacement Plan. This review should be based on industry best practices and ensure that the current inventory, as well as the life cycle of apparatus, meets both the operational and financial requirements of the Worcester Fire Department.

ESCI noted that the Worcester Fire Department has a Staff/Utility Vehicle Replacement Plan but that it is outdated. In late 2017, the City Manager made a commitment to help improve the fleet. The city has purchased 14 staff/utility vehicles since then, with two more approved in FY 22. The Staff/Utility Vehicle Replacement Plan should be updated to reflect these recent purchases and to prioritize the next vehicles for replacement.

Support Equipment

Support Equipment includes self-contained breathing apparatus (SCBA), radios, cardiac monitors, and other assorted high-value equipment. ESCI observed support equipment that was in service at all 10 fire stations. The equipment was generally well-maintained and in good condition.

Support Equipment Replacement

The Worcester Fire Department does not have a replacement schedule in place for support equipment. Equipment Replacement Plans should be established to ensure an inventory of equipment that is in good general repair and scheduled for replacement, including SCBA, radios, semi-automatic external defibrillators, and other high-value equipment. An Equipment Replacement Plan will allow the Worcester Fire Department to determine a funding source and establish a budget for its support equipment.

Fleet Maintenance

National Fire Protection Association 1901: *Standard for Automotive Fire Apparatus* recommends that fire apparatus 15 years of age or older be placed into reserve status, and apparatus 25 years or older should be replaced. This is a general guideline, and the standard recommends using the following objective criteria in evaluating fire apparatus lifespan:

- Vehicle road mileage.
- Engine operating hours.
- The quality of the preventative maintenance program.
- The quality of the driver-training program.
- Whether the fire apparatus was used within its design parameters.
- Whether the fire apparatus was manufactured on a custom or commercial chassis.
- The quality of workmanship by the original manufacturer.
- The quality of the components used in the manufacturing process.
- The availability of replacement parts.

The following figure is one example of criteria that can be utilized for determining apparatus replacement based on a points system. The method examines age, apparatus mileage or hours, service, condition, and general reliability.

Figure 92. Criteria & Method for Determining Apparatus Replacement

Evaluation Components		Points Assignment Criteria	
Age:		One point for every year of chronological age, based on in-service date.	
Miles/Hours:		One point for each 10,000 miles or 1,000 hours	
Service:		1, 3, or 5 points are assigned based on service-type received (e.g., a pumper would be given a 5 since it is classified as severe duty service).	
Condition:		This category takes into consideration body condition, rust interior condition, accident history, anticipated repairs, etc. The better the condition, the lower the assignment of points.	
Reliability:		Points are assigned as 1, 3, or 5, depending on the frequency a vehicle is in for repair (e.g., a 5 would be assigned to a vehicle in the shop two or more times per month on average, while a 1 would be assigned to a vehicle in the shop an average of once every three months or less.	
Point Ranges		Condition Rating	Condition Description
Under 18 points		Condition I	Excellent
18–22 points		Condition II	Good
23–27 points		Condition III	Consider Replacement
28 points or higher		Condition IV	Immediate Replacement

Staffing

The size and structure of an organization's staffing are dependent upon the specific needs of the organization. These needs must directly correlate to the needs of the City of Worcester, as a structure that works for one agency may not necessarily work for another. This section provides an overview of the Worcester Fire Department's staffing configuration and management practices.

Fire department staffing can be divided into two distinct groups. The first group is typically recognized by the citizens and is commonly known as the operations section; it can be generally classified as the emergency response personnel. The second group works behind the scenes to provide the support needed by the operation's personnel to deliver an effective emergency response and is commonly known as the administrative section or support services section. Like many fire departments, the Worcester Fire Department has distinct staff personnel, Chief Officers, who perform specific administrative functions but are also required to perform operationally if the need arises.

While a fire department's evaluation focuses on several factors, staffing is one of the most important. When reviewing staffing, one must define the expectations of each work unit in addition to the organization's overall performance. Once the work product (output or outcome) is defined, and performance metrics are established, senior leadership assumes responsibility in determining appropriate staffing necessary to accomplish goals and meet performance objectives.

Administration & Support Staffing

One of the primary responsibilities of the administrative team is to ensure that the operations segment of the organization has the ability and means to respond to and mitigate emergencies safely and efficiently. An effective administration and support services system is critical to the success of the Department.

Typical responsibilities of the administration and support staff include planning, organizing, directing, coordinating, and evaluating the various programs within the Worcester Fire Department. This list of functions is not exhaustive, and other functions may be added. It is also important to understand that these functions do not occur linearly and can more often occur simultaneously. This requires the Fire Chief and administrative support staff to focus on many different areas concurrently.

The following figure illustrates the administration and support structure of the Worcester Fire Department.

Figure 93. Administrative Staffing

Position Title	No. of Full-Time Positions	Hours Worked per Week	Work Schedule
Fire Chief	1	40	M-F
Deputy Chief – Administrative & Support	1	40	M-F
Deputy Chief – Operations	1	40	M-F
District Chief – Safety	1	40	M-F
Supervisor of Administration	1	40	M-F
Program Manager	1	40	M-F
Data Analyst	1	40	M-F
Account	1	40	M-F
Principal Clerk	1	40	M-F
Total Administrative and Support Staffing	9		

The Worcester Fire Department's administrative functions are led by the Fire Chief and supported by two Deputy Chiefs, a District Chief, and five civilian positions for a total of 9 full-time equivalents (FTE) positions. This represents 2.2% of the department's total staffing of 392 full-time positions. It is ESCI's experience that effective administrative staffing totals for municipal fire department operations typically range from 12 to 15% of agency totals. After reviewing the functions and responsibilities assigned to the workgroup, ESCI concluded that the number of full-time equivalents (FTE) assigned resides in the extreme lower range of the normally experienced administrative levels to support the responsibilities of the Worcester Fire Department's administration appropriately.

Training

The Worcester Fire Department Training Facility sits on a 1-acre site which has the following:

- Training Division building containing office space for division staff, male/female locker rooms, one (1) classroom, and one (1) training/exercise room.
- 4-story burn building designed for Class A burns constructed of steel covered with sheet metal and the burn rooms lined with padgenite insulation. The building is 18 years old and was last inspected in November 2010.
- Search and rescue prop.
- Roof prop designed to simulate the various roof pitches found in their jurisdiction.

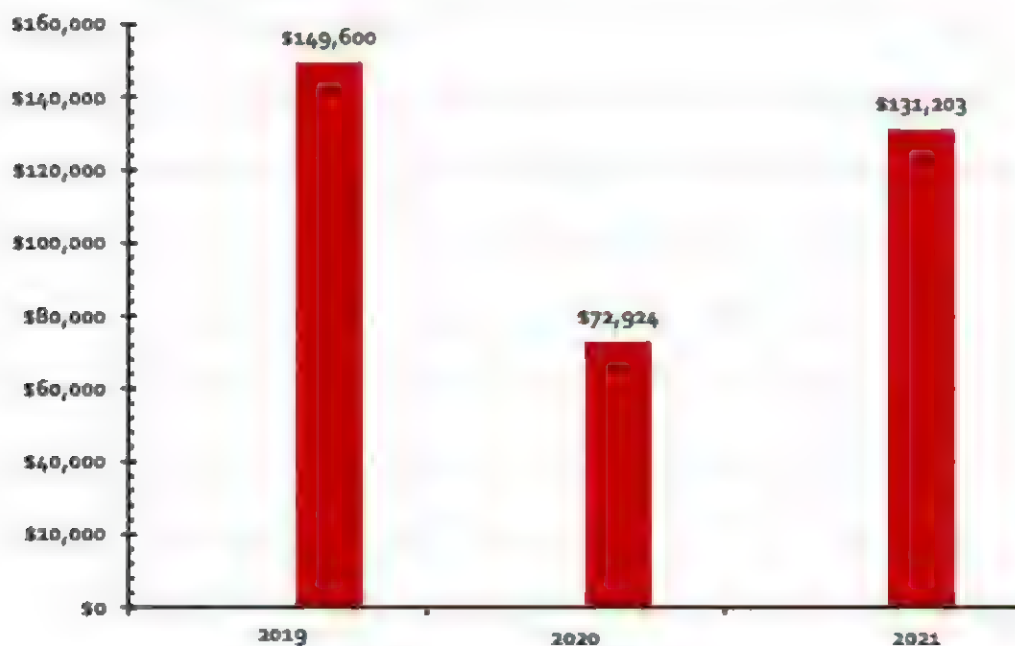
The Training Division comprises four full-time staff members—a District Chief, Captain, Lieutenant, and Firefighter. Responsibilities of this division include:

Figure 94. Worcester Fire Department Training Division Responsibilities

Worcester Fire Department Training Division Responsibilities	
Veteran's Affairs Benefits and Narcan Grant Administration	
Entry-Level Firefighter Hiring	
Managing the Drill School	
Probationary Firefighter Training and Evaluation	
Inservice Training	
Recordkeeping	

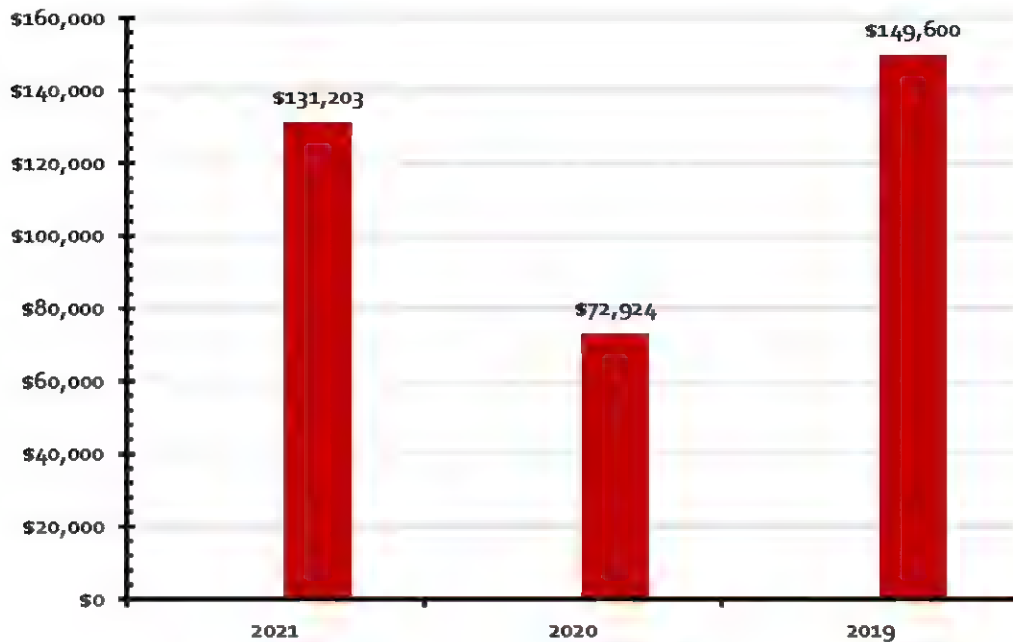
In January of each year, the Training Chief meets with the Deputy Fire Chiefs to discuss what training they feel is necessary for the coming year. There is no formal process to determine training needs; however, in recent years, the focus has been on the delivery of "Back to Basics" training.

The Training Division heavily relies on the use of overtime to provide training to the Worcester Fire Department. Overtime is paid to both assigned Training Division Staff as well as adjunct instructors who work on the line. Annual required training such as Hazardous Materials, CPR, and First Responder Recertifications are almost always taught by adjunct instructors. ESCI notes that the COVID-19 Pandemic likely impacted the numbers for the year 2020.

Figure 95. Worcester Fire Department Training Division Overtime Hours

The costs associated with the use of overtime by the Training Division are as follows. ESCI again notes that the COVID-19 pandemic likely impacted the numbers for the year 2020.

Figure g6. Worcester Fire Department Training Division Overtime Dollars



Veteran's Affairs and Narcan Grant Administration

The firefighters assigned to the division primarily serve in an administrative role, ensuring that all necessary paperwork for recertification, VA benefits, Narcan grant, and any other required documentation is completed and filed appropriately.

ESCI noted during the site visit that the current philosophy of the Training Division has become “We can do this, or we can do that, but we can’t do both simultaneously.” During applicant processing, division staff has limited availability to address other responsibilities such as Inservice Training during Drill School; therefore, all other training and coordination from the division are suspended during that time.

The Entry-Level Firefighter Hiring Process

For the past few years, the Worcester Fire Department has hired a class of 20–30 new firefighters annually. The process of hiring a class has several steps that are completed by multiple entities:

Figure 97. The Entry-Level Firefighter Hiring Process

The Entry-Level Firefighter Hiring Process	
1.	The City of Worcester requests a list of eligible candidates from the Civil Service Unit.
2.	Following receipt of the list, the Training Division conducts an Information Night for an established number of candidates. Typically, this number is two times the number needed for a class, plus 5, ex.; For a class of 30, 65 candidates would be invited to Information Night.
3.	The Training Division conducts oral interviews with each candidate.
4.	The Training Division performs background checks on each candidate.
5.	The Training Division sends the list of candidates to the Worcester Human Resources Department to schedule medical examinations, psychological evaluations, and Drug Screening.
6.	The Worcester Human Resources Department sends a list of candidates to the Worcester Fire Department Training Division to conduct a physical ability test.
7.	The Civil Service Unit provides the final list of qualified applicants to the Worcester Fire Department.

This entire process starts in September and takes six months to complete. The elements assigned to the Worcester Fire Department are all completed by four of the Training Division's full-time staff members.

Drill School

Massachusetts General Law Chapter 670, Section 165A, provides the statutory authority for the Massachusetts Fire Training Council to administer the fire service certification process for entry-level firefighters in the Commonwealth. This certification process utilizes the National Board on Fire Service Professional Qualifications (Pro Board) standards. The Council recognizes NFPA 1001: *Standard for Firefighter Professional Qualifications* to the level of Firefighter I and II for entry-level firefighters but does not require it.

The Worcester Fire Department does not require training staff to adhere entirely to NFPA 1001 during entry-level training; however, the training program does follow the standard. All firefighters are certified as a Firefighter I / II through the Pro Board process administered by the Massachusetts Fire Academy prior to being assigned to an emergency response unit.

All Worcester Fire Department firefighters also receive First Responder certification and Hazardous Material Operations-level Responder in accordance with NFPA 472: *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents* prior to graduation from Drill School. These certifications are maintained through annual continuing education training for their career.

Drill School for new firefighters typically begins the first Monday in March and lasts for approximately 16 weeks (640 hours). To staff the Drill School, in addition to the four full-time staff, the Division Chief of Training selects four additional instructors from the field who are assigned to the division full time for the duration of the Drill School. There is no requirement for instructors to have additional training or certification such as NFPA 1041: *Standard for Fire and Emergency Services Instructor Professional Qualifications*. Instructors are selected based on time on the job, experience, and stature in the department and are typically officers. All training is conducted at the Worcester Fire Department Training Facility except for Class B (fuel) fire training which is conducted at the Massachusetts Fire Academy.

Driver/Operator Training

There is no driver or apparatus operator certification for firefighters with the Worcester Fire Department. Every firefighter is taught, as part of the 16-week Drill School, to pump the engine. If available, the firefighter is taught how to operate the aerial ladder. Additionally, while in Drill School, all firefighters attend a two-day Department of Transportation (DOT) vehicle operator course. This is an in-house training following the DOT standard for the driving course. The remaining driver/operator training is conducted at the company level by the officer and other senior members. Firefighters rotate, sometimes weekly or monthly, through the driver position on the apparatus they are assigned.

Probationary Firefighter Training and Evaluation

Once a firefighter graduates from the 16-week Drill School and has attained their Pro Board ORL status, they are assigned to an officer on a unit for the remaining time they are on probation. This period of time is usually 36 weeks. In the past, probationary firefighters were rotated to different officers and types of units quarterly. Because of the pandemic, this practice was stopped, and it is now the position of the Training Division that keeping a probationary firefighter with the same officer for the entire 36 weeks is most beneficial.

While on probation, the firefighter must complete a Task Book comprised of the most common drills and evolutions performed by the Worcester Fire Department. Additionally, their performance is rated monthly by a 1–4 scoring system by their assigned officer. During the last month of probation, a representative of the Training Division meets with each firefighter and reviews their monthly ratings and Task Book for completeness. During this meeting, firefighters may be required to perform a drill and are required to complete the department's physical fitness evaluation before being recommended for permanent status.

Inservice Training

The department requires eight drills per month of company-level training for all personnel. There are no assigned training topics except when delivering *Back to Basics* training. Initially, each Thursday was identified as the *Back-to-Basics* training day. Three companies at a time would report to the Training Facility, receive train-the-trainer instructions on a specific topic, and provided a “blueprint” or step-by-step PowerPoint. The personnel would then take these skills back and continue to train on the subject. The Training Division occasionally sends out mandatory drills when there is a need for the department as a whole to focus on a skill, new piece of equipment, etc.

During 2020, because of the pandemic, the division could not have multiple companies assemble; therefore, the *Back-to-Basics* training is now being delivered to one unit at a time. Training that used to take two weeks to deliver takes more than a month under these conditions. In addition, following the 2018 LODD the Worcester Fire Department experienced, all members were trained on a 2:1 lowering system to aid in victim removal from above-grade.

In early 2021, when pandemic restrictions were eased, Worcester Fire Department Training Division scheduled all of its crews to complete two cycles of training evolutions on transitional attacks, hose deployment, MAYDAY, and rapid intervention operations. The fire department conducted two rounds of 96 evolutions each in order to schedule each crew for these two evolutions.

Incident Command Training

For the rank of Captain and above, all officers have completed the National Incident Management System (NIMS) Independent Study (IS) 100, 200, 700, and 800 courses. A NIMS Incident Command System (ICS) 300 course was offered last year but not every officer attended. Recently, the department was awarded a grant to fund the Blue Card Incident Command Training System. Lieutenants and above are assigned the independent study portion, which is to be completed by January. In the early spring of 2021, an instructor-led train-the-trainer was delivered to those who completed the independent study portion. As of June 2021, Worcester Fire Department has nearly completed the 34-hour instructor-led Command Center Training for all participants.

Refresher Training

Any member who returns to emergency response who was out for six months or longer must complete a 1-week refresher training program conducted by the division. This training consists of covering anything missed while gone, any equipment introduced during the absence, an air consumption drill, a live fire training evolution, and a demonstration of proficiency on the type of unit to which the firefighter is assigned.

Officer Development

All newly promoted Lieutenants attend a two-week officer development course.

Training Records

The Worcester Fire Department maintains several types of training documents, company training drills, and programmed course rosters. For company training, each company is required to complete eight drills a month. Documentation of these drills is submitted through a Google Form that populates to a spreadsheet.

For programmed training, rosters are created using the Records Management System (RMS), PAMET (SECURUS), and rosters are scanned into the network. Course rosters are maintained electronically within the Worcester Fire Department RMS. Interviews with Training Division staff revealed that these records are seldom reviewed because the application is not user-friendly or easily searchable.

Training Policies and Procedures

Specific to training, there are no written procedures or manuals to guide training activities. Within the department's intranet system resides a section where various drill guides, primarily in PowerPoint format, are located and can be accessed by the company officer. Recently, the division has created a "blueprint" for classes and drills that will be used for future classes. Before this, each instructor had to create their own training guide during Drill School. The goal of the division is to have all the various training activities captured on a template for others to easily use in the future. While the department maintains guides to engine and truck company operations, there are no specific guides or procedures that spell out what each riding position on an apparatus does based on the type of incident.

The Worcester Fire Department Training Division is tasked with completing multiple overlapping tasks with little in the way of formal preparation for success. Training and certification for pump operator, driver operator, fire officer certifications, and instructor certifications are other examples of common prerequisites and industry best practices that are not required within the Worcester Fire Department. Finally, the influence of outside instructors, ideas, or procedures is rare within the organization, if they occur at all.

The policies within the Worcester Fire Department Training Division do not follow industry best practices or national standards. While experience and on-the-job training are important components of progressing from entry-level to journeyman, and finally to expert status, this training provides the foundation for which to build that knowledge and skill.

Fire Prevention

Worcester Fire Prevention operates out of the inspectional services building located at 25 Meade Street. NFPA 1730: *Standard on Organization and Deployment of Fire Prevention Inspection and Code Enforcement, Plan Review, Investigation, and Public Education Operations* is the national standard for fire prevention activities.

Fire Prevention is one aspect of the global concept of Community Risk Reduction. NFPA 1035: *Standard on Fire and Life Safety Educator, Public Information Officer, Youth Firesetter Intervention Specialist, and Youth Firesetter Program Manager Professional Qualifications* defines Community Risk Reduction as "programs, actions, and services used by a community, which prevent or mitigate the loss of life, property, and resources associated with life safety, fire, and other disasters within a community." Community Risk Reduction includes preventing fires as well as a variety of other dangers.

National best practices suggest that Community Risk Reduction Programs should include the Five E's of Emergency Response: Education, Enforcement, Engineering, Economic Incentives, and Emergency Response.

Figure 98. The Fire E's of Emergency



The Worcester Fire Prevention Division is comprised of the following units:

Figure 99. Fire Prevention Division Units

Worcester Fire Prevention Division Units

Code Enforcement
Fire Investigations
License
Public Education
Plans Review

Staffing for this division includes:

Figure 100. Fire Prevention Staffing

Worcester Fire Prevention Division Staffing

Position	Authorized Quantity	Actual Quantity
District Chief	1	1
Captain	1	1
Lieutenants	7	6*
Firefighters	11	10
Principal Bookkeeper	1	1
Fire Protection Engineer	1	1
Signal Maintainer	1	1
Total	23	21

*Public Educator Firefighter temporary promotion to Lieutenant

The division is staffed Monday through Friday. Currently, there is no on-call coverage after normal business hours. Division staff reported that the availability of staff after hours for enforcement questions and fire investigations is currently about 50% of the time. When staff is not available, complaints, code enforcement, and investigations are generally followed up on a Monday morning. Fire Prevention Overtime has been in excess of \$50,000 during fiscal years 2019 and 2021. FY 2020 is not included as data for that year was incomplete.

Figure 101. Fire Prevention Overtime 2019 and 2021*

Overtime Type	FY 19 Overtime Dollars	FY 21 Overtime Dollars
Fire Investigation Unit	\$42,103	\$33,319
Regulatory/Plans Review	\$15,989	\$13,217
General Prevention	\$6,155	\$6,149
Total	\$64,247	\$52,685

*2020 is not included as data is incomplete

Professional Qualifications

NFPA 1730 requires that personnel assigned to the Fire Marshal's Office meet the minimum requirements of NFPA 1031: *Professional Qualifications for Fire Inspector and Plans Examiner*, NFPA 1035: *Standard on Fire and Life Safety Educator, Public Information Officer*, and NFPA 1033: *Standard for Professional Qualifications for Fire Investigator*.

The Worcester Fire Department assigns members of the fire department to the Fire Prevention Division through either the promotional process or as a re-assignment of duties within the department. Under the current promotional process, Lieutenants and District Chiefs are assigned to wherever there is an opening, so more often than not, they come from a line position into the Fire Prevention Division with no minimum qualifications. Newly promoted Lieutenants and District Chiefs usually bid out of Fire Prevention to return to a line position as soon as one becomes available.

Figure 102. Fire Prevention Division Staffing Turnover, 2015–2021

Staffing Turnover		
Position	Number of Position Turnovers	Notes
District Chief	5	Average tenure 14 months
Lieutenant	16	Longest tenure 17 months; Shortest tenure 1 month
Average Tenure in Fire Prevention	8 months	

The turnover rate is high due the fact that there is no minimum stay for personnel assigned to the Division. This has led to issues with continuity of operations, customer service, skill sets, and morale. Members of the department who are preparing to retire often chose to spend their last years of service working in the Fire Prevention Division, so this Division experiences retirements more often than many other Divisions within the fire department. Currently, there are no minimum qualifications for Worcester Fire Department personnel to become members of the Fire Prevention Division. ESCI's Interviews with employees in this Division revealed that the only training most had received was "on the job."

The Massachusetts Fire Prevention Officer (FPO) Credential is issued by the Massachusetts State Fire Marshal. This is a multi-level training credential program and both level I and level II are good for three years and can be renewed. The credential is an effort to acknowledge the fire prevention officers committed to their professional development. It is not the intent to set standards or qualifications for an individual to hold the designation of Fire Prevention Officer but to establish credentials based on education, training, and experience criteria relevant to serving as the fire prevention officer.⁵⁰

In April 2017, the Worcester Fire Department implemented a 24-hour shift schedule. This schedule likely also had an effect on the staffing of the Fire Prevention Division because some credentialed employees chose to return to the line to work the 24-hour shifts.

Figure 103. Fire Prevention Credentials Before and After Implementation of 24-Hour Shifts

Worcester Fire Prevention Division Staff Credentials	
Before 24 Hour Schedule Implementation	After 24 Hour Schedule Implementation
16 firefighters credentialed as FPO 1	1 firefighter credentialed as FPO1
9 firefighters without FPO 1 credentials	11 firefighters without FPO1 credentials
11 officers credentialed as FPO1	2 officers credentialed as FPO1
4 officers without FPO1 credentials	16 officers without FPO1 credentials
Total	
27 FPO1 Credentialed Staff Members	3 FPO1 Credentialed Staff Members
13 Staff Members without FPO1 Credentials	27 Staff Members without Credentials

Code Enforcement

The Code Enforcement Unit is staffed by one Captain, two Lieutenants, eight firefighters, a Signal Maintainer, a principal bookkeeper, and a Superfund Amendment and Reauthorization Act (SARA) Officer.

⁵⁰ <https://www.mass.gov/how-to/how-to-apply-for-a-fire-prevention-officer-credential>

Section 313 Emergency Planning and Community Right-to-Know Act (EPCRA), which is also known as Title III of the Superfund Amendments and Reauthorization Act (SARA), requires certain facilities to report both routine and accidental chemical releases. These businesses must submit reports to the Environmental Protection Agency (EPA) and the state emergency response commission (SERC) by July 1 for each preceding year.

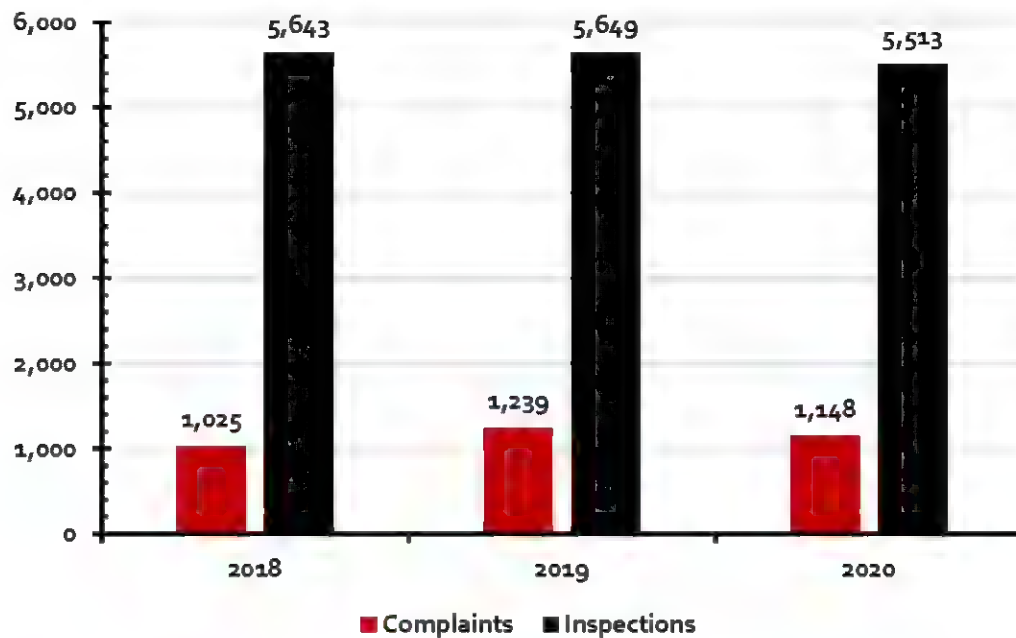
The members who are assigned to this group are responsible for the administration and enforcement of all applicable state laws and local ordinances. Specific functions include:

Figure 104. Code Enforcement Unit/Inspection Functions

Code Enforcement Unit/Licensing Inspection Functions
Complaint Investigations
Enforcement of Fire Codes and Local Ordinances
Quarterly and Annual Inspection in accordance with MGL 148, Section 4
Issuance of Violation Notices
Issuance of Permits and Monitoring of Blasting Operations
Issuance of Orders to Abate
Administration and Enforcement of MGL Ch. 148 Section 26F relative to smoke and carbon monoxide detection in single-family homes
SARA Hazardous Materials Compliance
Fire Alarm Signal Repair and Maintenance

During each of the last three years, the Code Enforcement Unit has responded to more than 1,000 complaints and performed more than 5,500 inspections. ESCI notes that the COVID-19 pandemic likely impacted the numbers for the year 2020.

Figure 105. Code Enforcement Unit Activity, 2018–2020

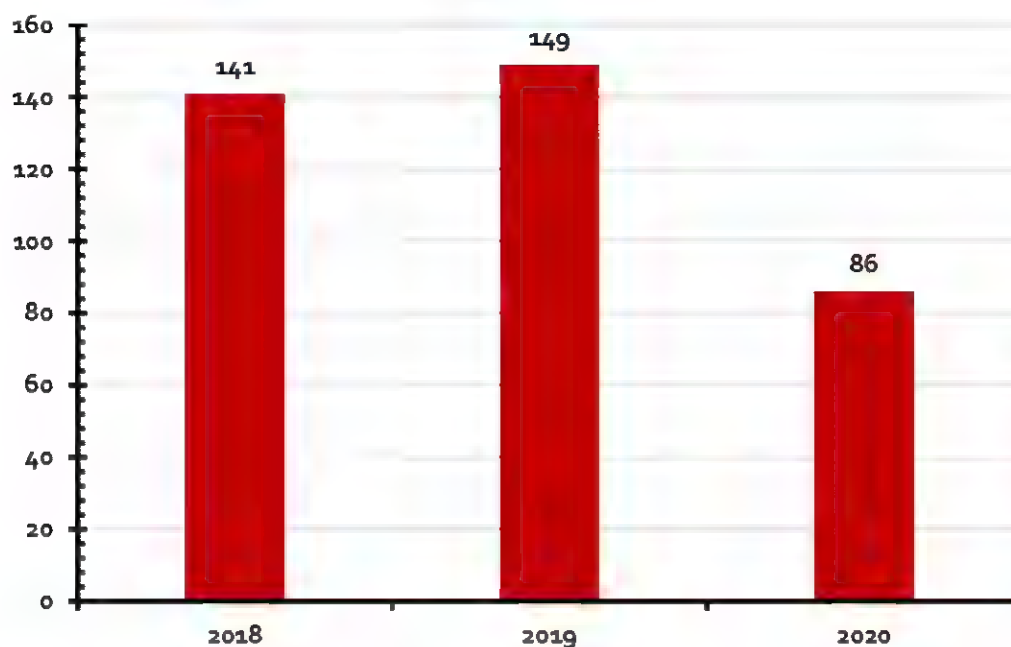


Fire Investigations

There are two Lieutenants assigned to the Fire Investigation Unit. Four years ago, the division was staffed with five fire investigators, however, all five were not primary investigators. Each had other primary duties.

At the time of this report, the Captain was a certified investigator and filled in when necessary. The Public Educator Firefighter (acting Lieutenant) was also certified and in the on-call rotation. The second Lieutenant assigned to Fire Investigation Unit was working on his certification.

The Fire Investigation Unit has investigated between 86 and 149 fires. ESCI notes that the COVID-19 pandemic likely impacted the numbers for the year 2020.

Figure 106. Fire Investigation Unit Activity, 2018–2020

In addition to conducting fire investigations in conjunction with the Worcester Police Department, members assigned to this division are also in charge of overseeing the Hot Work and Lock Box Programs for the department. These additional duties with the current staffing shortage within the division have the potential to affect the quality and consistency of these vital programs.

License

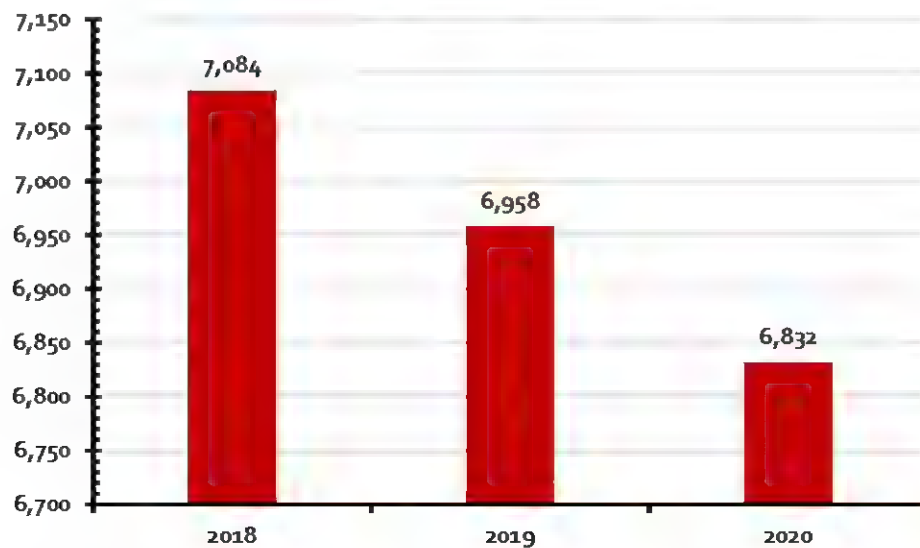
Two firefighters are assigned to the License Unit. This unit is responsible for the inspection and issuance of licenses and permits in accordance with Mass. 527 CMR 1.00 Massachusetts Comprehensive Fire Code. Specific functions include:

Figure 107. Licensing Unit Functions

Licensing Unit Functions
Inspection of Repair Garages including Repair Shops and Auto Detailing
Inspection and Issuance of Permits for Spray Painting Booths
The Inspection and Issuance of Licenses for Flammable Liquid Storage
Lodging and Rooming House Inspections
College Dormitory, Fraternity and Sorority House Inspections
Massachusetts 304 Liquor Licensing Permits
Oil Burner Permits
Propane Tank and Storage Permits
Commercial Kitchen and Spray Booth Installations
Fire Alarm System Inspection for Single Family Homes
Food Truck Inspections
Tank Removal Permits
Compliance Checks for Liquor Licenses Permits
Details for Hot Work and Basting Permits

The License Unit issued approximately 7,000 licenses, permits, or other certificates during each of the last three years. ESCI notes that the COVID-19 pandemic likely impacted the numbers for the year 2020.

Figure 108. License/Permit/Certificate Activity, 2018–2020



The current workload is split between two licensing inspectors. Currently, the inspectors operate on the following annual schedule:

Figure 109. Licensing Unit Operating Schedule

Licensing Unit Operating Schedule	
Schedule	Activity
January–March	Lodging and Rooming House Inspections
April	Invoices
May–June	Repair Shops
July–August	All other inspections
September	Dorms, Fraternities, and Sororities
October–December	Liquor Licensing Inspections

The inspectors reported that, due to the immense workload, they are usually not able to follow up on deficiencies in a timely manner. In addition, the inspectors voiced frustration that a lack of current technology negatively impacted their ability to effectively use their time to perform inspections and follow up on any discrepancies.

Public Education

One Lieutenant and one Firefighter are assigned to the Public Education Unit.

The Worcester Fire Department's Public Education Unit has developed a very robust Community Risk Reduction Program. This program has been recognized on a national level, including presentations made at the Vision 20/20 Conference.

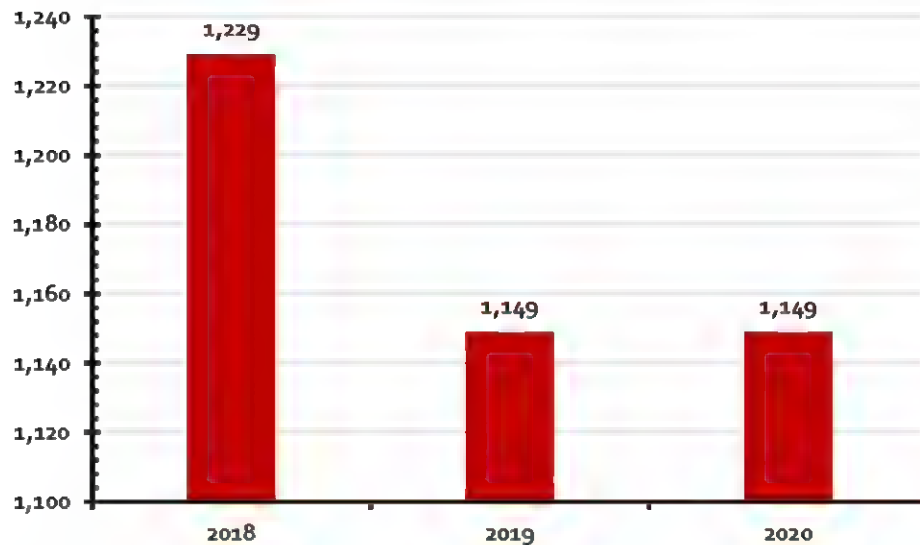
While they reported being challenged by a lack of technology to aid them in tracking data, the members of the Public Education Unit have done their best to implement a data-driven approach to determining how to provide support and education within the community. Programs include:

- **School-Age Children:** The Public Education Unit reported reaching between 20–28% of school-aged children with a focus on Pre-Kindergarten through 3rd grade, with 3rd graders being evaluated to validate the retention of what they have been taught.
- **College Students:** As the City of Worcester is home to nine colleges and universities, the Public Education Unit has developed a fire safety program that focuses on dormitory safety. They also run the smart burner safety program, which has been able to show a significant reduction in cooking-related fires within the city.
- **High-Risk Populations:** The Public Education Unit has partnered with community stakeholders such as the Worcester Housing Authority and local senior centers to provide education to High-Risk Populations.

Plans Review

The Plans Review unit is staffed by a civilian Fire Protection Engineer; the Captain of Fire Prevention dedicates a significant amount of his time to the Plans Review Process as well. This unit is charged with conducting site and building plan reviews. The Plans Review Unit has processed between 1,149 and 1,229 plan reviews during each of the last three years. ESCI notes that the COVID-19 Pandemic likely impacted the numbers for the year 2020.

Figure 110. Plans Review Unit Activity, 2018–2020



With the recent economic growth within the city, there has been a major resurgence in both new construction and remodeling. Building owners within the city have increased the number of permits for new construction and renovations over the last several years, which has placed a larger burden on the two personnel assigned to this unit. This group also works closely with the building inspectors to review site and building plans to ensure compliance with all applicable codes and standards.

Safety Division

The Safety Division is staffed by a District Chief of Safety who oversees four captains. The four captains are assigned to the department's four shifts.

The Safety Division is tasked with completing After Action Reviews for all fires that have three or more alarms.

Maintenance

The Maintenance Division is staffed by the following individuals:

Figure 111. Maintenance Division Staffing

Worcester Fire Prevention Division Staffing	
Position	Quantity
Senior Apparatus Repair	1
Plant Engineer	1
Apparatus Repairmen	3
Total	5

This division oversees fleet maintenance for 70 vehicles as well as small equipment, including lawnmowers. When vehicle or equipment issues occur, a work order is generated by line staff to report the issue, and the Maintenance Division then takes the item in for repair.

Operations Staffing

The Operations Division is responsible for responding to calls for service.

Staff Allocation of Various Functions

Safe and effective emergency operations require the rapid deployment of sufficient quantities of well-trained personnel and equipment. These resources must be strategically located to quickly respond, while also ensuring they can back up other response units which may be out of service on another emergency. This concept will be discussed in depth in the *Service Delivery* analysis section of this study. The following figure lists the department's emergency response staffing.

Worcester firefighters staff 13 engines, seven ladder companies (two aerial platforms and five ladders), a heavy rescue company, and a special operations vehicle (cross-staffed with Ladder 4). Daily minimum staffing for the Worcester Fire Department consists of 70 firefighters, the maximum is 92 firefighters.

Minimum unit staffing is three firefighters per Engine or Ladder Company and five firefighters assigned to the Rescue Company.

The Worcester Fire Department staffs two District Chiefs per shift. The city is divided geographically into two response "districts" each of which is assigned to a District Chief.

Figure 112. Worcester Fire Department Total Emergency Response Staffing

Position Title	Number of Positions
Operational Staff (full-time & part-time)	<i>Individuals considered full-time employees, primarily assigned to provide emergency services at the operational level.</i>
District Chief – Special Operations	1
District Chief	8
Captain	21
Captain – Safety	4
Lieutenant	63
Firefighter	272
Firefighter – Safety	1
Total	370

A baseline overview of the staffing model, staffing levels, and relief factors provides an opportunity to review and analyze the current staffing patterns, shifts, and options to increase efficiency, effectiveness, and capabilities. The two District Chiefs provide general direction and support for operations staff as well as command level assistance when needed at incidents with additional alarms. The Worcester Fire Department operates with an officer assigned to each company; however, when the officer is absent, firefighters “ride up” as the officer.

Considerable ongoing local, regional, and national discussion and debate draws a strong focus and attention to the matter of firefighter staffing. Frequently, this discussion is set in the context of firefighter safety. The jurisdiction has chosen to establish response demand zones and use the criteria outlined in NFPA standards. As detailed in the *Service Delivery and Performance* section of this report, NFPA 1710, 2020 edition, specifies the number of firefighters assigned to an engine company to be a “minimum of four on-duty personnel per engine company.”⁵¹

ESCI notes that the more critical issue is the number of firefighters assembled at the scene of an incident in conjunction with the scope and magnitude of the job tasks expected of them, regardless of the type or number of vehicles upon which they arrive. NFPA 1710 recommends that the number of on-duty fire suppression members shall be sufficient to perform the necessary firefighting operations given the expected firefighting conditions.⁵² The standard further recommends that the numbers shall be determined through task analyses that take the following factors into consideration.

⁵¹ NFPA 1710 2020 ed.: 5.2.3.1.1.

⁵² NFPA 1710 2020 ed.: 5.2.2*.

Figure 113. Staffing Factors⁵³

Staffing Factors
Life hazard to the populace protected.
Provisions of safe and effective firefighting performance conditions for the firefighters.
Potential property loss.
Nature, configuration, hazards, and internal protection of the properties involved.
Types of fireground tactics and evolutions employed as standard procedure, type of apparatus used, and results expected to be obtained at the fire scene.

The total number of positions required becomes a policy decision based on the needs of the jurisdiction. The jurisdiction also establishes the number of employees needed above the minimum to allow for vacancies due to vacation, sick, and other types of leave. This staff requirement above the minimum yields a total number of full-time employees required to ensure necessary daily minimum staffing is achieved according to policy. ESCI makes specific recommendations regarding the Operational Staffing of the Worcester Fire Department in the *Opportunities and Recommendations* section of this report.

In some fire and EMS departments, applying the relief factor to a specific rank or classification is based on staffing criteria. The above exercise considers the entire operations staffing group and does not distinguish between officer and line staffing or the use of operations staff in other areas. In these cases, the relief factor may be more or less than the overall number identified here. This becomes a policy decision and is usually based on specific staffing needs or criteria of the specific rank or classification in question.

Special Operations

The District Chief of Special Operations is responsible for all of the functions that support Special Operations throughout the Worcester Fire Department. These responsibilities include but are not limited to:

⁵³ NFPA 1710 2020 ed.: 5.2.2.1.

Figure 114. District Chief of Special Operations Responsibilities

District Chief of Special Operations Responsibilities
Maintenance and Repair of all Gas Meters
Maintenance and Repair of all Thermal Imaging Cameras
Respond to all 3 rd Alarms
Report to all Emergency Operations Center Activations
Report to all Real Time Police Department Crime Center Activations
Coordinate Mutual Aid including responding on all Mutual Aid Requests outside of the City
Participate in the Monthly Chiefs' Meeting
Manage the Dive Team including coordinating training and equipment
Manage the Technical Rescue Team coordinating training and equipment
Maintenance and Repair all Hydraulic Rescue Tools
Maintenance and Repair of Portable Radios
Liaison to the Worcester Airport for training and drills
Funeral Committee and Honor Guard; planning of annual memorials
Responsible for Marine 1 (boat at Lake Quinsigamond) maintenance, putting in the water in the spring and removing for the winter.
Responsible for District 7 Special Operations Truck and D7 Trench trailer with all related equipment.
Liaison to Fire Alarm

ESCI's review of the functions assigned to the District Chief of Operations revealed that the responsibilities exceed what one full time employee can be reasonably expected to fulfill during a normal work week. Given the critical nature of the equipment and operations related to Special Operations, ESCI recommends that the City of Worcester consider assigning a second position – perhaps a Lieutenant – to better distribute the Special Operations workload.

Service Delivery and Performance

As an emergency services delivery organization, the response and efficiency of the Worcester Fire Department are the most visible elements of the organization. Understanding when and where incidents are most likely to occur and deploying an appropriate response for a given incident or hazard justify the resources the department requires to perform its mission. This section analyzes multiple facets of service demand, deployment, and performance of the Worcester Fire Department, benchmarks performance against industry standards, and provides a gap analysis for potential improvements to the service delivery system.

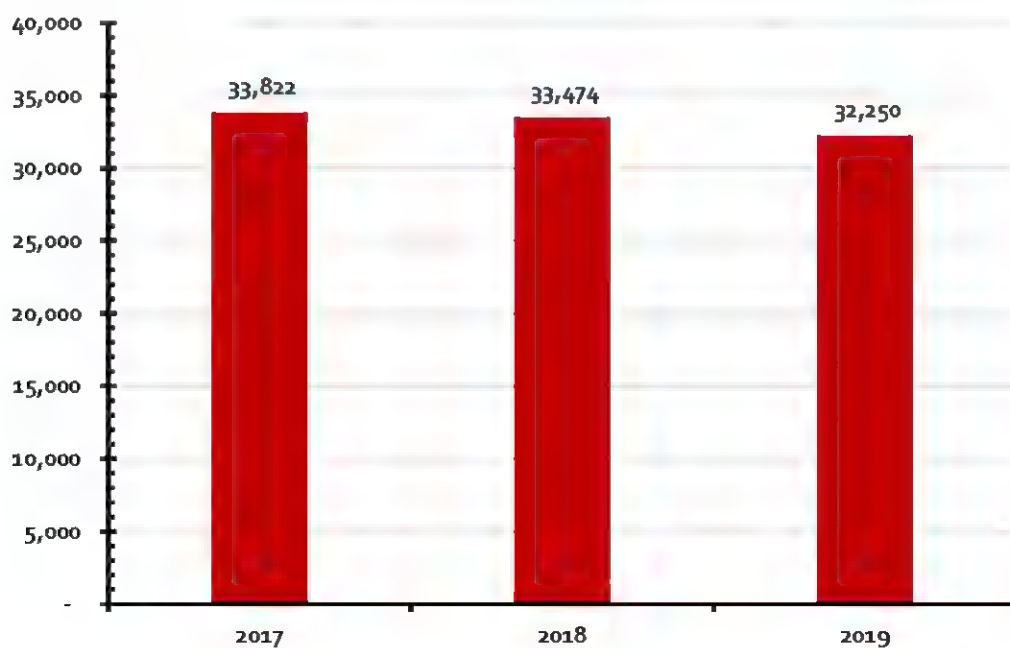
Service Demand Review

The demand for services drives WFD's mission to provide a safe and vibrant community through risk reduction, preparedness, and proactive all-hazards response. The ways in which Worcester Fire Department resources are deployed, the types of services provided, and the way training is accomplished should be reflective of the types of incidents to which the department responds, the level of risk associated with those incidents, and the relative frequency of occurrence of these incident types.

Trends in the data provided can provide insights into how service demand may change year to year and the major categories of incident types. Knowledge of when high demand periods occur will assist Worcester Fire Department in determining whether staffing levels are sufficient for that demand, and in scheduling additional duties such as training, fire safety inspections, and vehicle maintenance.

First, annual calls for service by calendar year are displayed.

Figure 115. Annual Calls for Service (2017–2019)

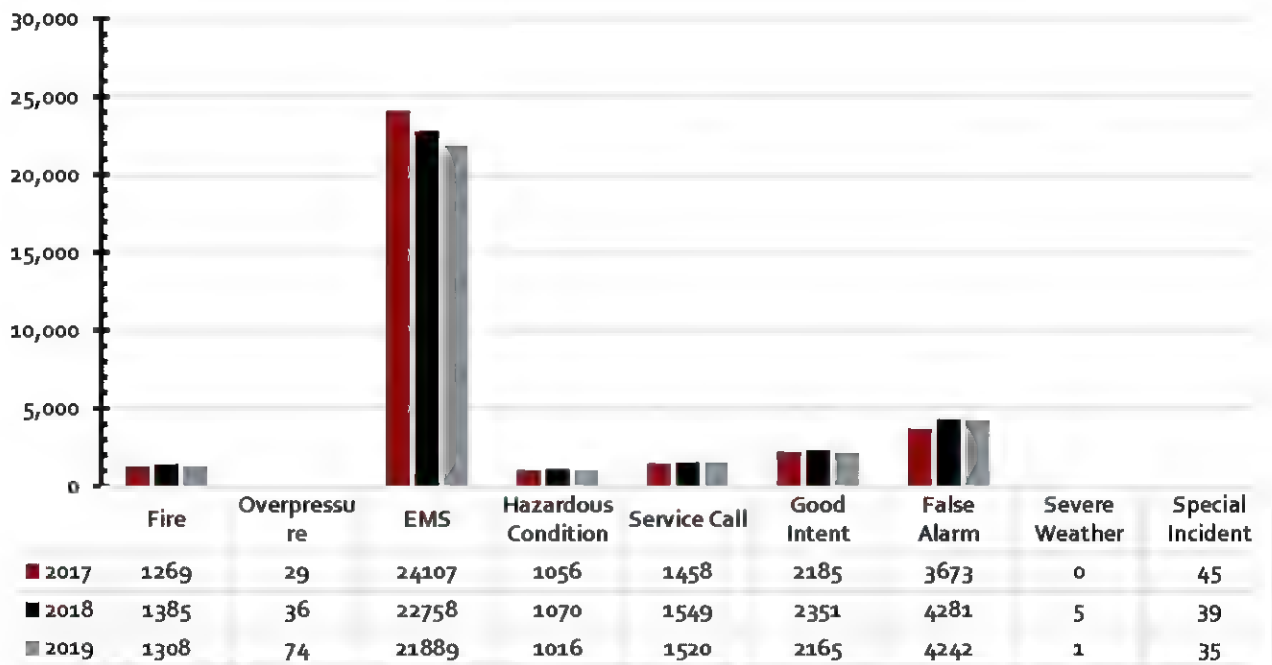


Service Demand by Incident Type

Demand for services was relatively consistent from year to year, with a 4.6% decrease from 2017 to 2019. In Figure 116, demand by incident type for 2017 through 2019 is provided. Categories used in this analysis are based upon the National Fire Incident Reporting System (NFIRS) guidelines for grouping of incident types. Within the NFIRS classifications, the following incident types are grouped within the corresponding series:

- 100 Fires
- 200 Overheat/Overpressure
- 300 EMS
- 400 Hazardous Conditions
- 500 Service Call
- 600 Good Intent
- 700 False Alarms
- 800 Severe Weather
- 900 Special Incident

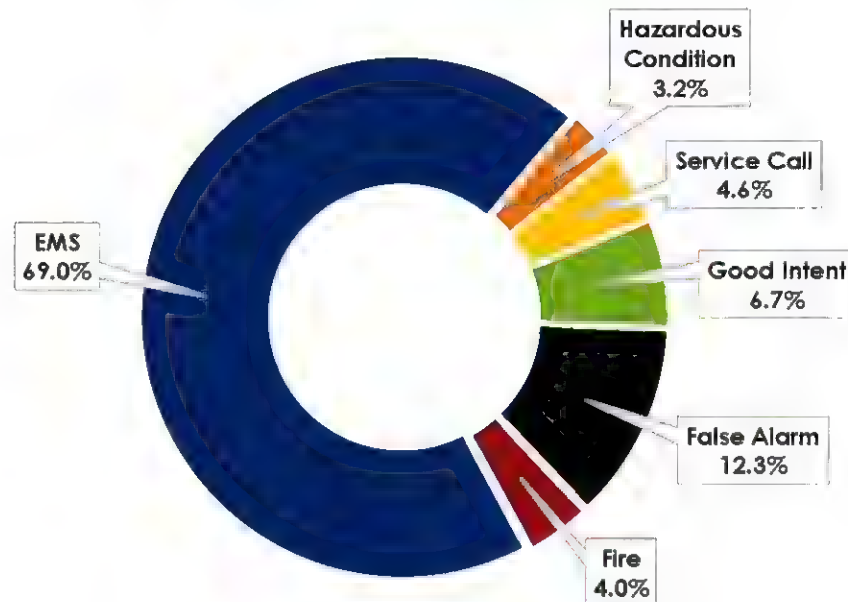
Figure 116. Service Demand by NFIRS Classification (2017–2019)



While most categories remained consistent year to year, a steady reduction in the number of EMS incidents and an increase in 2018 for false alarms are the most notable exceptions. Service demand for 2020, while not included in this analysis, was dramatically impacted by the COVID-19 pandemic, and resulted in a decrease in calls for service. For trending purposes, 2020 and most likely 2021 will deviate from historic trends seen in 2019 and prior.

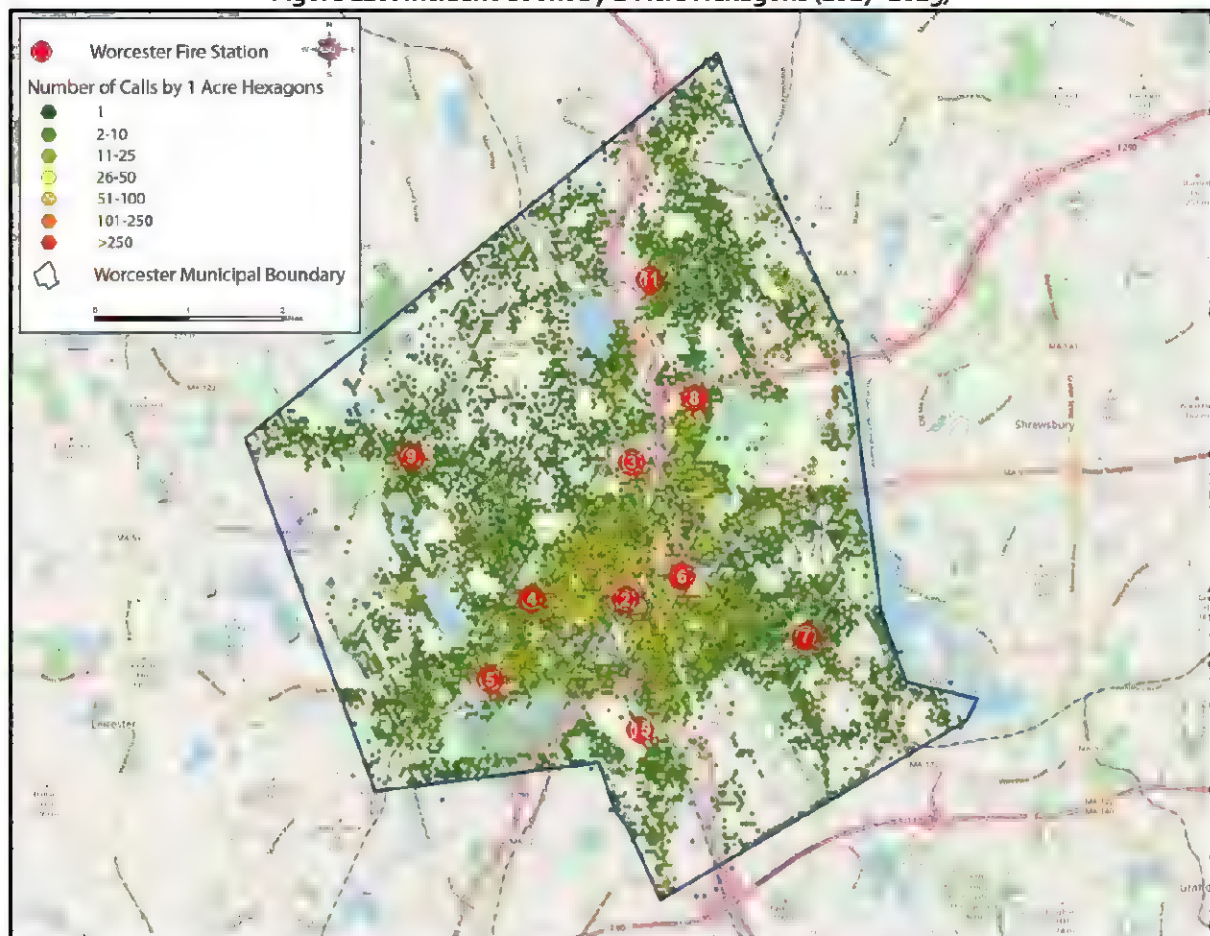
To provide a comparison of incident types relative to one another, Figure 117 provides incident types by their frequency of occurrence for three calendar years.

Figure 117: Service Demand by Incident Frequency (2017–2019)



EMS incidents represent the greatest percentage (69.0%) of call types for WFD. False alarm responses are next (12.3%), followed by good intent (6.7%) and service calls (4.6%), and finally fires (4.0%) and hazardous conditions (3.2%).

Finally, incident totals based on location are shown to provide a visual representation of how incident location impacts WFD. Using GIS software, the city was subdivided into 1-acre hexagons and the total number of incidents occurring in each for the period 2017 through 2019 are displayed.

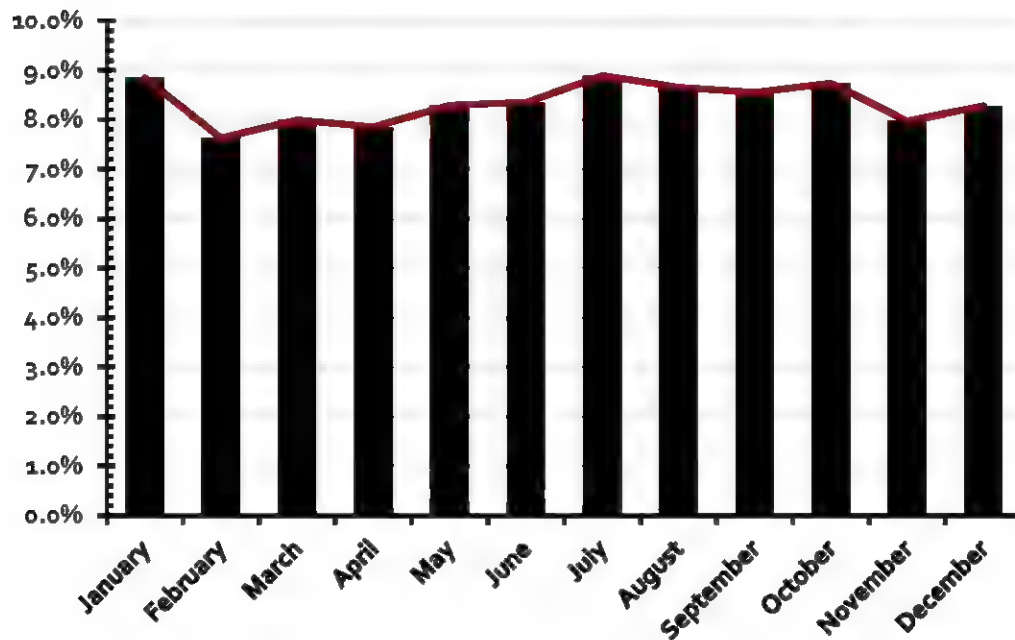
Figure 118. Incident Count by 1-Acre Hexagons (2017–2019)

In this figure, the highest densities of incidents occur within the core of the city. Additionally, the locations of fire stations within the city are situated such that more resources are provided to areas experiencing the greatest demands for services. When travel times across the city are evaluated, the call volume of the area being evaluated should be considered to weigh the associated cost of improvements versus the benefit of those improvements. Knowing the location and frequency of where incidents occur provides a deeper understanding of the service demand throughout the City of Worcester.

Temporal Variation

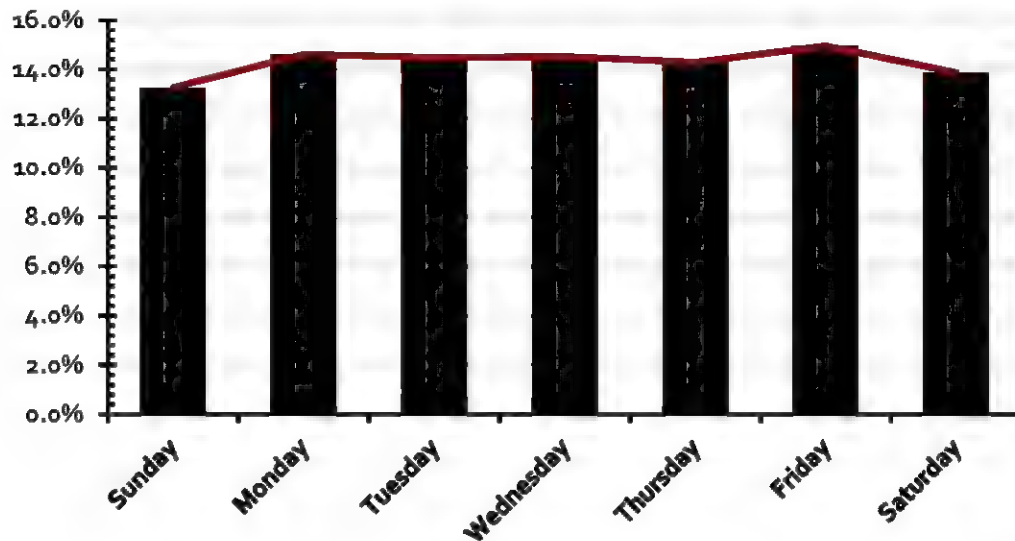
Understanding when increases or decreases in service demand are most likely to occur provides Worcester Fire Department with insights into when to anticipate higher or lower levels of service demand and staff accordingly. By examining patterns of demand by month, day, and hour, temporal patterns emerge as to when the greatest levels of demand are occurring. First, temporal variation by month is illustrated.

Figure 119. Service Demand by Month (2017–2019)



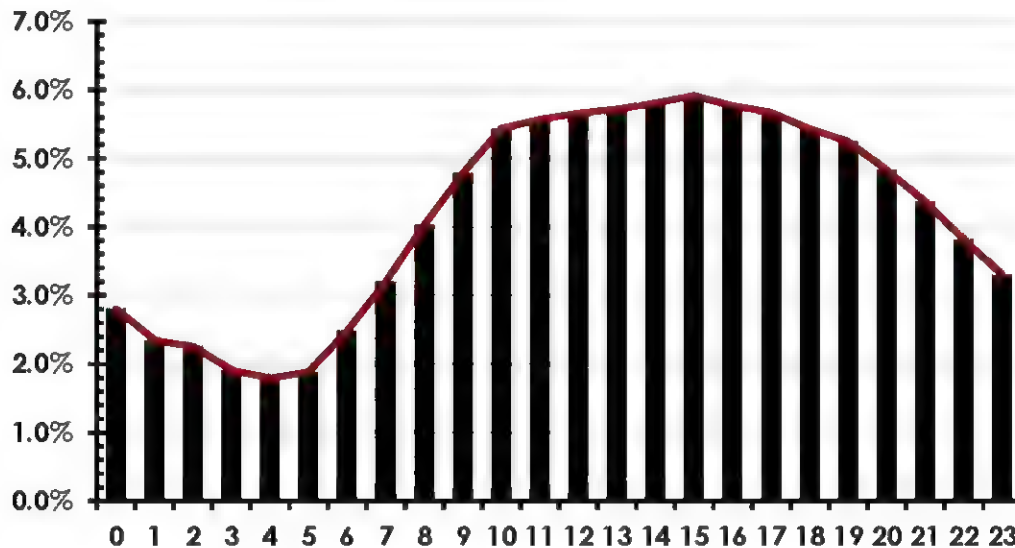
Demand for services is fairly consistent month to month, with a peak occurring in January and the lowest level of demand in February through April and November. The months with the greatest demand are January, then July through October, when the community is more likely to be active during warmer weather.

Figure 120. Service Demand by Day of Week (2017–2019)



Demand by day of the week illustrates a typical pattern of more activity during the work week and decreased call volume on the weekends. Fridays are the busiest days, followed by Mondays.

Figure 121. Service Demand by Hour of Day (2017–2019)



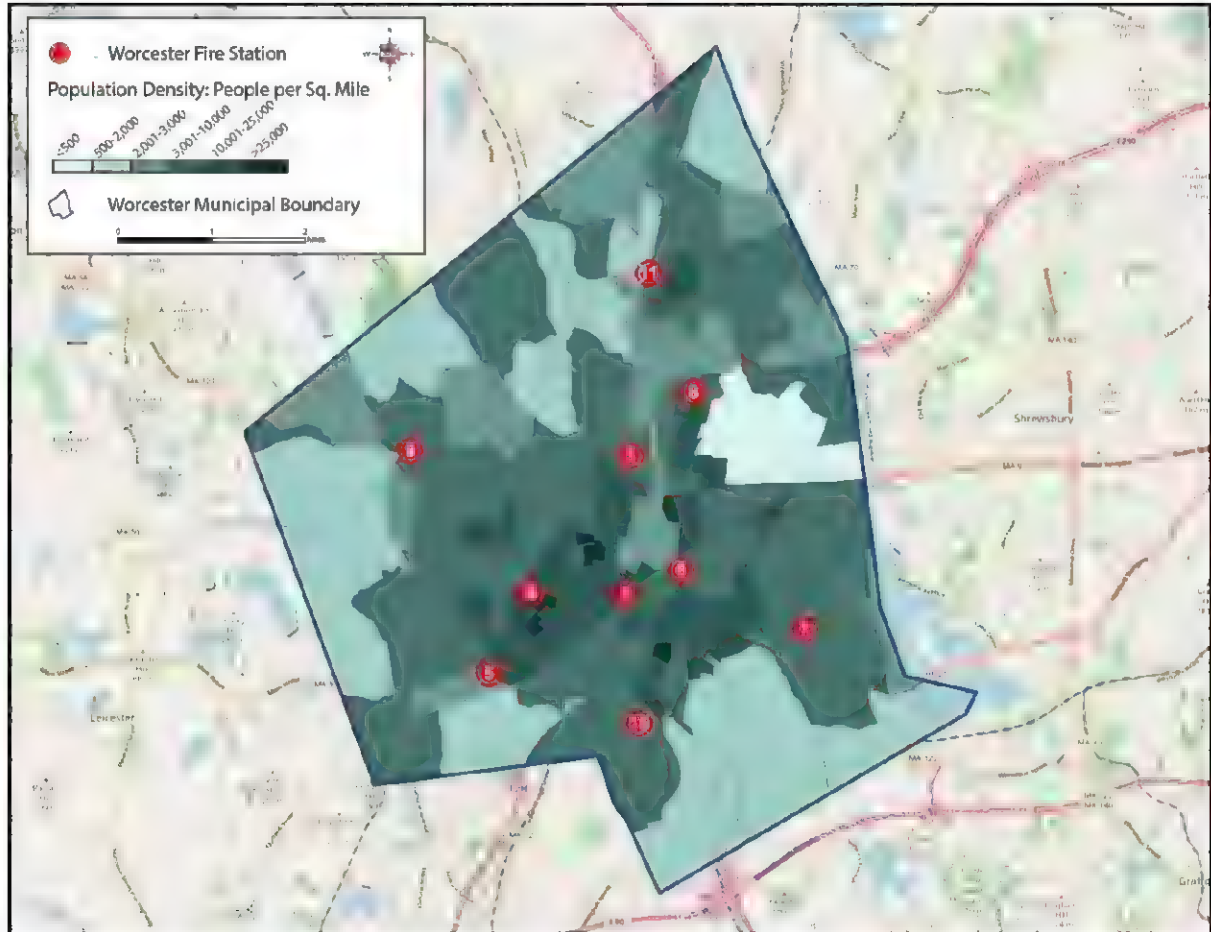
Service demand by the hour of day also illustrates a typical pattern of activity increasing around 6 a.m., peaking at mid-afternoon, and steadily decreasing throughout the night to the low point in the early morning hours.

When evaluating these figures together, Worcester can expect to have its highest levels of demand during the summer on weekdays from 11 a.m. to 7 p.m. Worcester Fire Department should consider this when scheduling training, inspections, or public education programs so that these and other functions are not competing with service demand and can be accomplished.

Population Density and Geographical Demand

Variations in the location and density of Worcester's population are driving forces behind the deployment strategy of its fire and rescue services. Worcester contains areas of high population density, coupled with triple-decker wood-frame homes and multilevel masonry buildings situated very closely together on steep hills. Access within these areas can be extremely limited for large suppression apparatus, and the conditions often demand greater numbers of personnel committed to responses for the safety and effectiveness of the response.

Figure 122. Population Density by Census Blocks (2020)⁵⁴

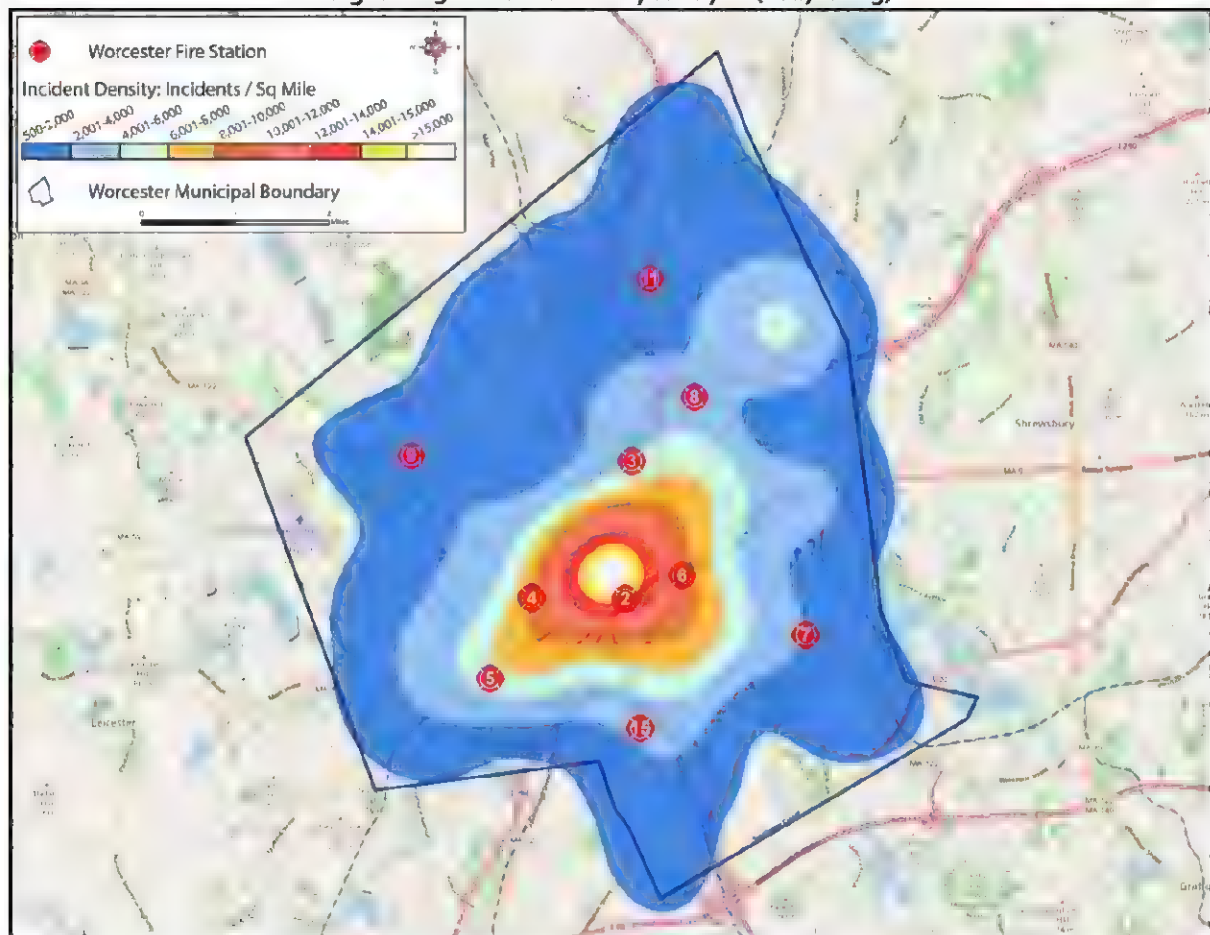


As illustrated in this figure, the central core of Worcester possesses high population densities and the nature of the construction, locations, power distribution, and terrain features make these areas resource-intensive when responding to medium to high-risk incidents, such as structure fires. The locations of Worcester's fire stations are reflective of this, with several stations clustered around the areas of greatest population densities.

⁵⁴ Esri Community Demographic Data, 2020.

The next figure provides an analysis of incident density using three years of fire rescue response data from January 1, 2017, through December 31, 2019. This analysis, commonly referred to as Hot Spot Mapping, calculates areas of greatest demand based on the density of incidents within an area. This analysis does not indicate how many calls occurred within each ring but instead provides a way to compare respective areas within the city to each other. In this analysis, each ring is calculated to display incidents per square mile and provides a range of how densely located calls for service were to each other.

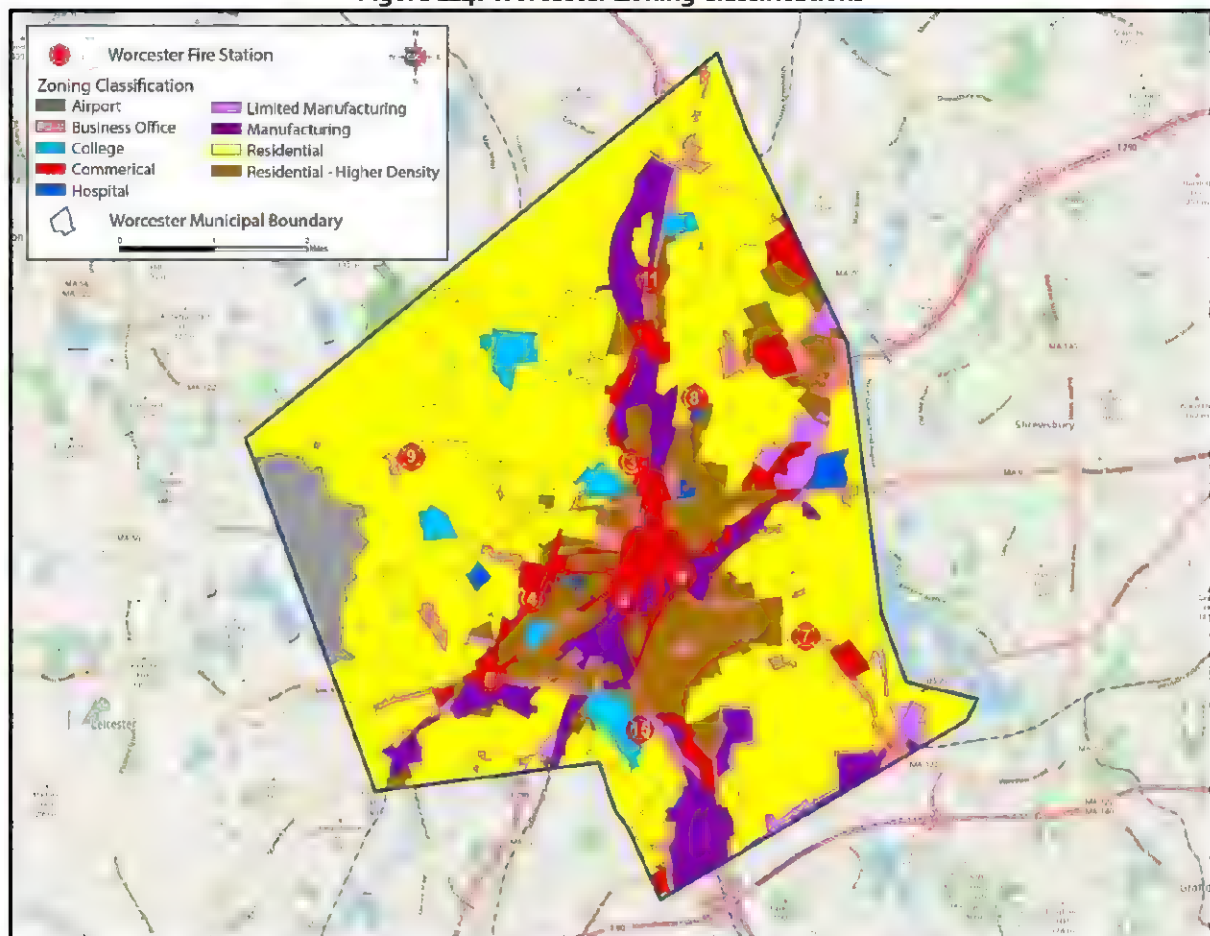
Figure 123. Incident Density Analysis (2017–2019)



In this figure, the area of greatest activity is easily identified, with Station 2 on the southern edge of the bullseye. While Worcester Fire Department appears to have a sufficient number of fire stations in this area, further consideration should be given for the extreme conditions that crews encounter when conducting suppression operations in these areas.

Finally, Worcester's zoning classifications are examined and related to the figures previously discussed.

Figure 124. Worcester Zoning Classifications



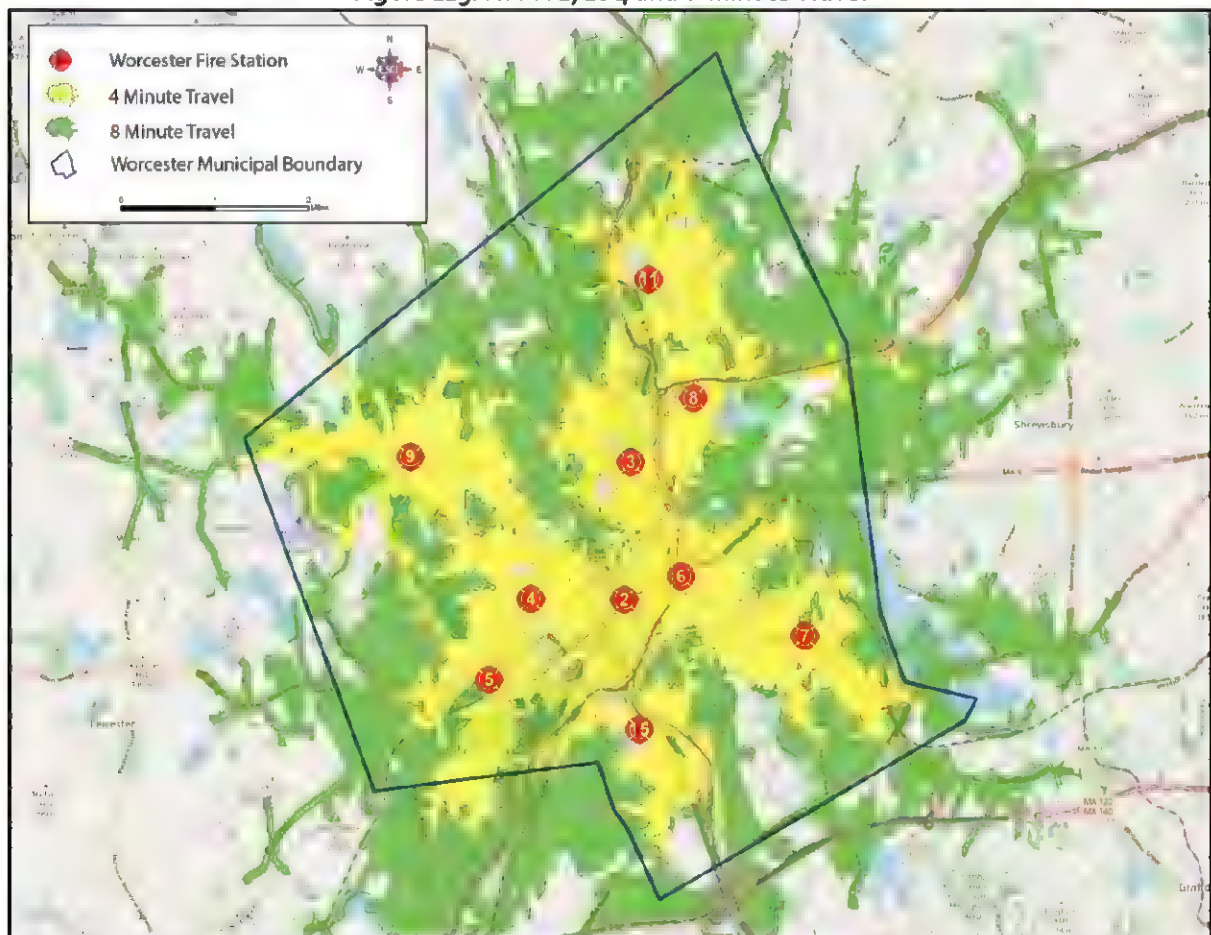
Areas of greatest demand in Worcester are composed primarily of commercial, high-density residential, and manufacturing occupancies. These occupancy types would typically dictate an increased response profile from the fire department as incidents at these types of occupancies require an intensive commitment of personnel. Coupled with the difficult terrain features, the closeness of buildings, height, construction type, and limited access, Worcester should consider whether the current deployment model provides sufficient staffing to safely and effectively conduct suppression operations while also maintaining accountability of personnel and ensuring safe and coordinated mitigation efforts are conducted.

Resource Distribution Analysis

NFPA 1710 Criteria

The National Fire Protection Association (NFPA) is an industry trade association that develops and provides standards and codes for the fire department and emergency medical services for use by local governments. One of these standards, NFPA 1710: *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments* (2020 ed.), serves as a national consensus standard for career fire department performance, operations, and safety. Within this standard, a travel time of 240 seconds, or 4 minutes, is identified as the benchmark for career departments to reach emergency calls within their jurisdiction with the first arriving unit. Additionally, the balance of the response (called the effective response force) is required to arrive at the incident within 480 seconds, or 8 minutes. Figure 125 provides a synopsis of WFD's ability to meet these standards based upon predicted travel times using historical traffic data from Esri for traffic patterns at 8 a.m. on Monday mornings. Unshaded pockets indicate that the area falls outside of the model's maximum extension from the road network.

Figure 125. NFPA 1710 4 and 8-Minute Travel



Assuming all units are available and in quarters, Worcester Fire Department can provide a response to the areas of greatest service demand within the city within the NFPA 1710 recommended 4-minute travel time for the initial arriving unit. While areas along Worcester's borders may experience a travel time slightly greater than 4 minutes, the areas in need of the most significant level of coverage lie within the minimum recommended travel time.

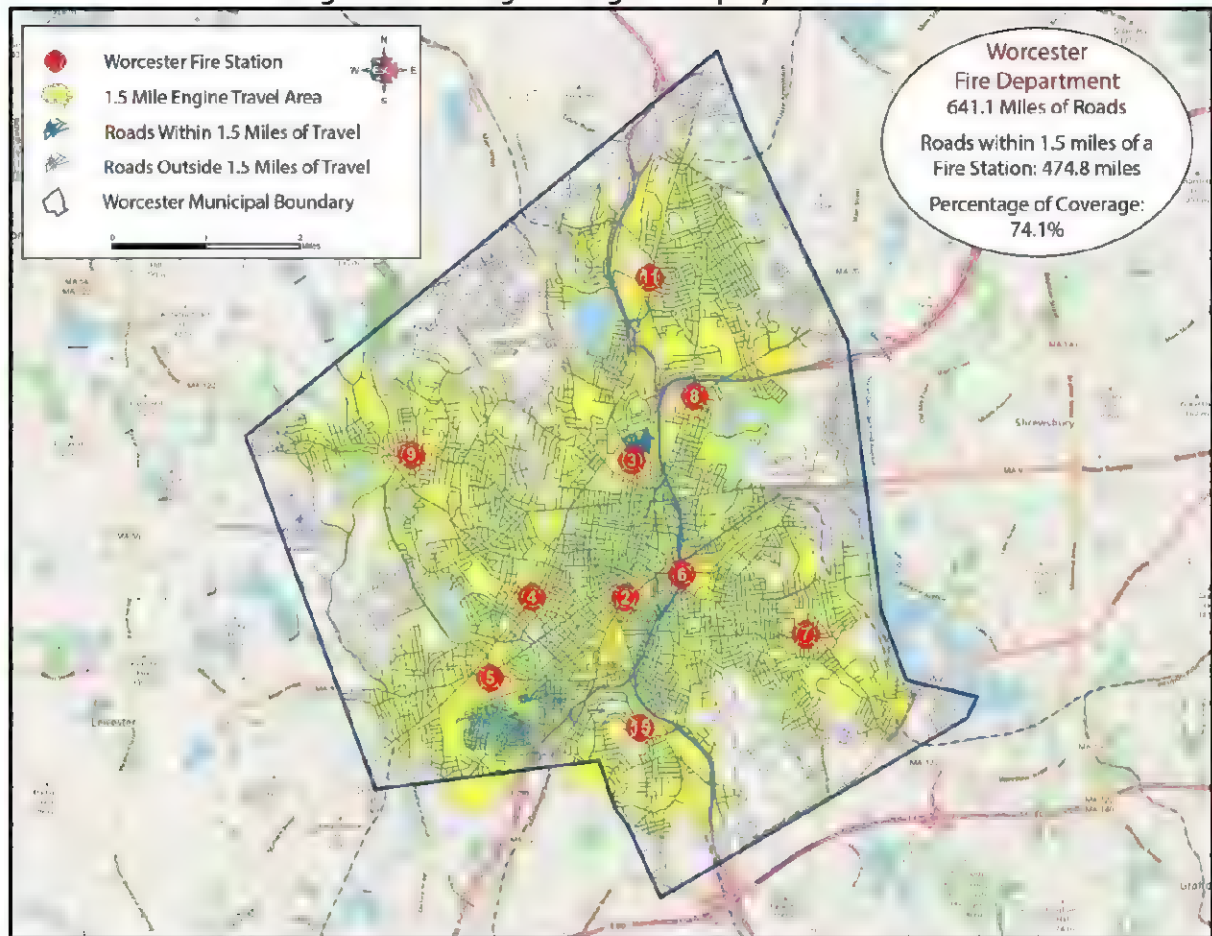
ISO Criteria

The Insurance Services Office (ISO) is a New Jersey-based advisory organization that provides insurance carriers with a classification rating of a local community's fire protection. The Property Protection Class (PPC®) score or rating classifies communities based upon an overall scale of 1 (best protection) to 10 (no protection) and assesses all areas related to fire protection. These areas are broken into four major categories, which include emergency dispatch and communications (10% of the rating), water supply system and distribution capabilities (40%), the fire department (50%), and Community Risk Reduction efforts (an additional 5.5% credit is available above 100%).

Engine Company Criteria

A key area of credit towards a jurisdiction's PPC® score is the degree to which structures protected by the fire department fall within a 1.5 road mile service area of a fire station. This 1.5 road-mile standard is used to estimate a 4-minute travel time for first responding units as required by NFPA 1710. In Figure 126, an analysis was completed for current fire stations with areas in yellow indicating those structures within a 1.5-mile drive. Based on the ISO engine company travel criteria, approximately 74% of Worcester's fire service area is included within the 1.5-mile travel distance.

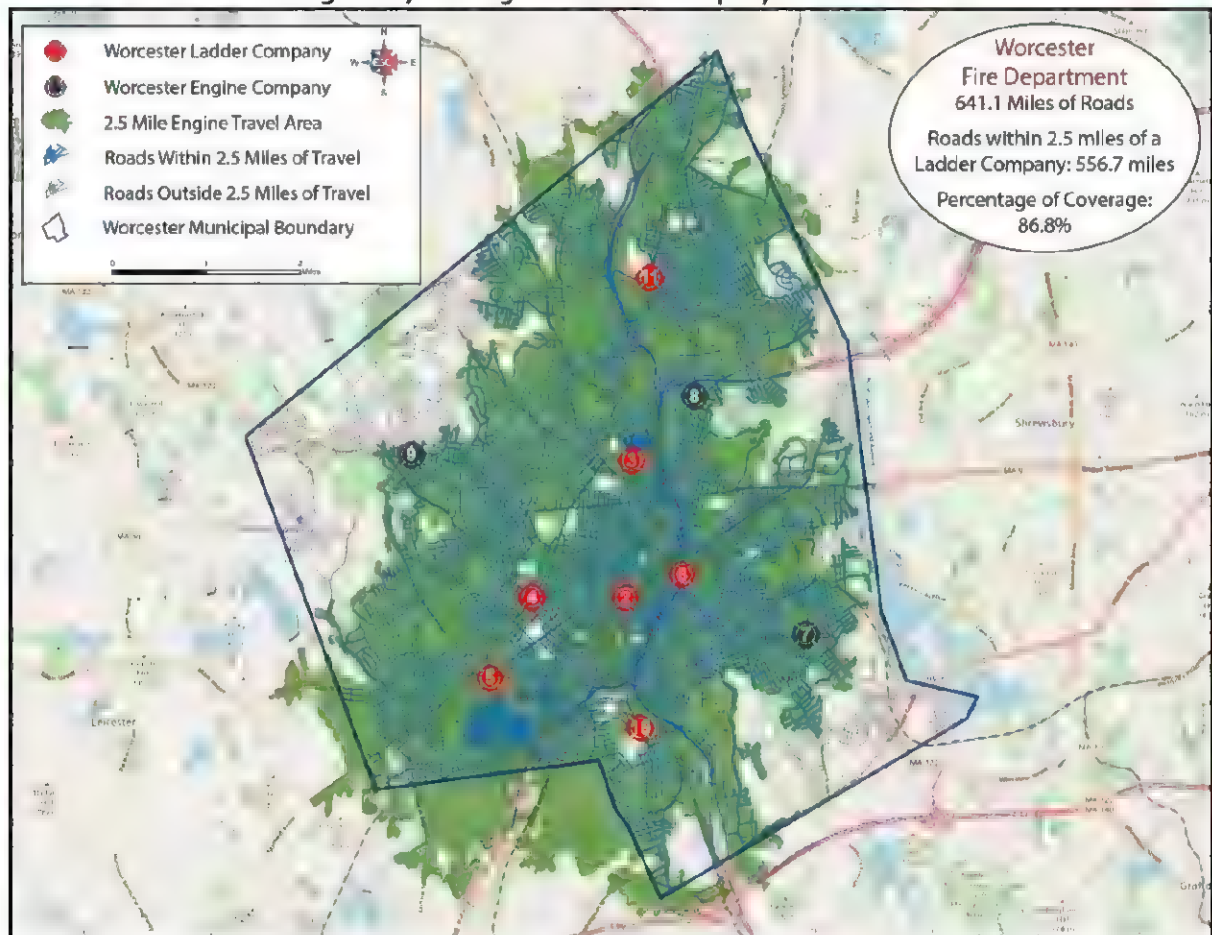
Figure 126. ISO 1.5-Mile Engine Company Service Area



Ladder Company Criteria

In many jurisdictions across the country, ladder companies are deployed only to certain types of incidents and are not necessarily considered as the first due unit for all other incident types. Because of this, ISO uses a 2.5 road-mile travel distance for ladder companies to estimate an 8-minute travel time in urban and suburban areas by ladder companies to provide the balance of personnel and equipment needed for incidents such as working fires. Figure 127 displays WFD's ladder company performance within the city. Based on the ISO ladder company travel criteria, approximately 87% of Worcester's fire service area is included within the 2.5-mile travel distance.

Figure 127. ISO 2.5-Mile Ladder Company Service Area



ISO Fire Station Coverage

To receive a PPC® rating that indicates fire coverage is available from ISO, structures must generally be located within 5-miles of a fire station. Areas outside of 5-miles are subject to receiving a PPC® rating of 10, meaning that no fire department coverage is available. Within the City of Worcester, all roadways lie within 5-miles of a fire station and are eligible to receive a rating based upon the performance of the fire department.

Figure 128. ISO Fire Station 5-Mile Service Area



ISO Water Supply

Access to water is a fundamental requirement for fire suppression in urban and suburban settings. Without an adequate supply of water, fire suppression operations are challenging. Additionally, the access point for this water supply must be located close enough to the structure to allow for rapid access by the fire department.

Next, fire hydrant coverage within the City of Worcester is displayed using ISO requirement that structures must be located within 1,000 feet of a fire hydrant.

Figure 129. ISO 1,000-foot Fire Hydrant Coverage



As an urbanized city, Worcester's water supply infrastructure provides coverage to nearly all areas of the city. While these roadways are located within 1,000 feet of a fire hydrant, the layout, building positioning, and terrain can make access to a water supply difficult in some areas, particularly on private roads which are not maintained by the city. While the city does plow private roads during the winter, many private roads are not paved and their inherent unevenness can make traversal treacherous. Worcester Fire Department should identify those areas where water supply could be challenging and modify response plans accordingly.

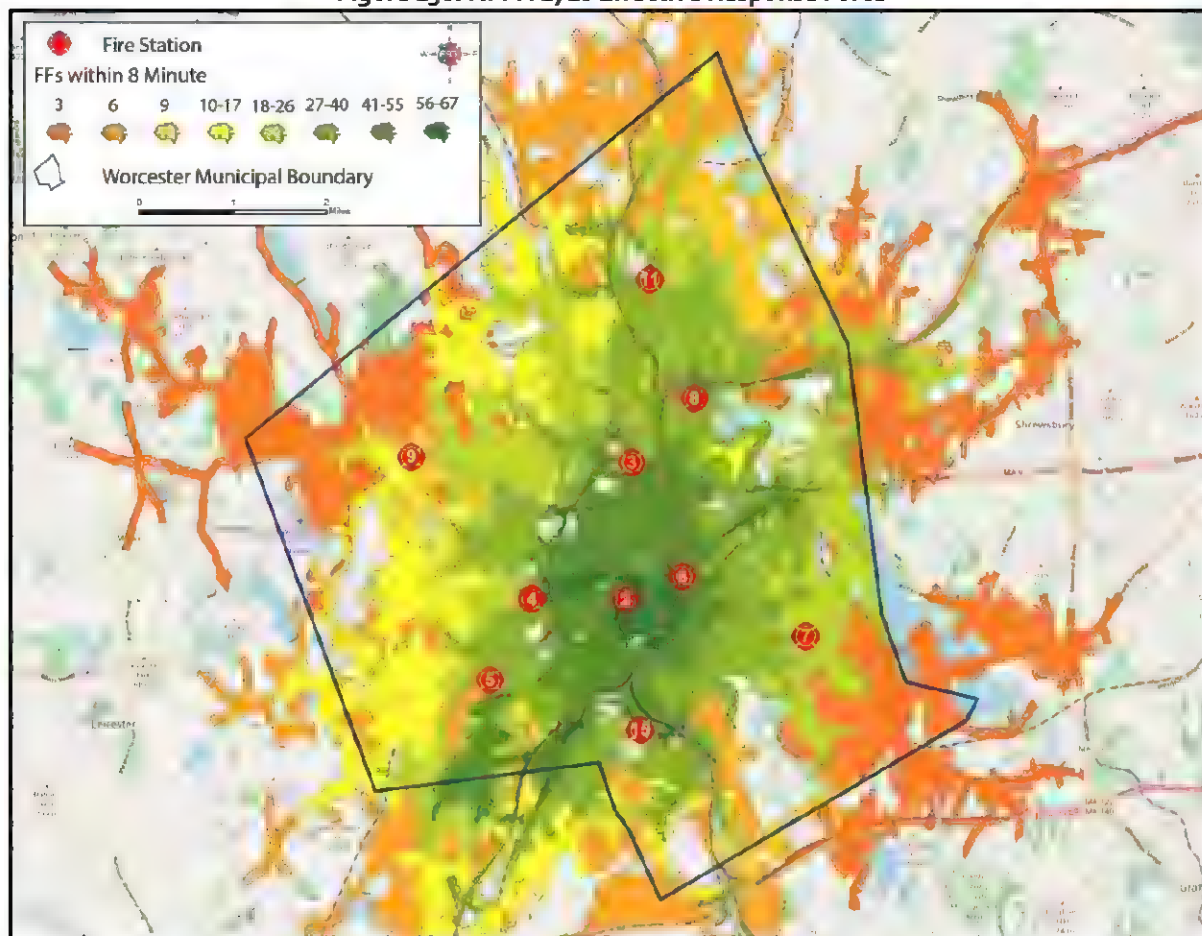
Resource Concentration Study

While most responses within Worcester are EMS in nature and are typically handled by one to two units, some incidents require large numbers of resources and personnel to mitigate the emergency condition and reduce loss safely and effectively. The ability of Worcester Fire Department to effectively deploy multiple units to an incident scene within a timely manner will often make the difference between minor damage and a total loss.

NFPA 1710 requires that for moderate risk incidents or greater, such as a fire in a 2,000 square foot residential dwelling, the balance of needed resources arrive at the scene within an 8-minute travel time. To achieve this, the concentration of WFD's resources were evaluated to determine how the spacing of multiple resources (the response apparatus within their respective fire stations) are arranged so that an initial Effective Response Force (ERF) can arrive on scene within the time frames outlined in the on-scene performance expectations. An effective response force is defined as "the minimum amount of staffing and equipment that must reach a specific emergency zone location within a maximum prescribed total response time and is capable of initial fire suppression, EMS, and/or mitigation. The ERF is the result of the critical tasking analysis conducted as part of a Community Risk Assessment."

To determine WFD's ability to assemble an effective response force, GIS software was used to overlay the daily minimum staffing at each station within 8-minute travel areas, then add the totals. The results are shown in Figure 130. This analysis presumes all units are available and in quarters with each unit's minimum staffing present. As some units will most likely be committed to other incidents at any given time, this figure provides a best-case scenario.

Figure 130. NFPA 1710 Effective Response Force



When all units are available and in quarters, WFD can theoretically provide a response to the center of the city with staffing numbers that meet NFPA 1710 standards; however, additional factors such as access by apparatus, the sheer density and height of buildings, the numbers of people living within those buildings, building condition, and weather can severely impact WFD's ability to conduct fire suppression operations safely and successfully. Because of the unique challenges faced during suppression operations, NFPA 1710 should be considered as the minimum level of staffing and the ability to assemble higher numbers of firefighters within a shorter time should be evaluated.

Currently, engine and ladder companies are staffed with three firefighters. This essentially results in operations where each crew is one firefighter short and can potentially lead to safety and accountability issues. Worcester should strongly consider establishing the staffing standards provided within NFPA 1710 as a minimum staffing model, acknowledging the benefits of 4-person suppression crews as recognized by NFPA 1710, the National Institute of Standards and Technology, and Underwriter Laboratories – Fire Safety Research Institute.

Additionally, Worcester should consider reevaluating the initial response sent to structure fires. Currently, the department responds the same type and number of resources to all reported fires within the city. However, certain locations, building types, and hazards will require a greater commitment of resources. Worcester Fire Department should evaluate each of these areas individually and ensure that appropriate numbers of equipment and personnel are activated on the initial notification by dispatch for the given risk or hazard.

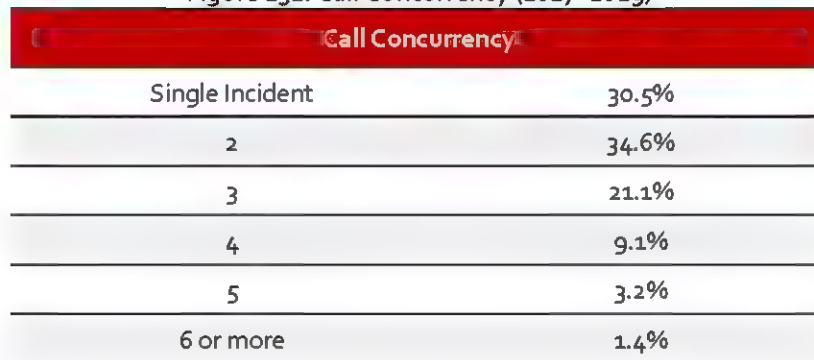
Response Reliability Review

In this section, resource reliability is evaluated using several metrics to establish a global perspective on WFD's ability to provide sufficient responding resources to meet service demand within the city. When all units are available and in quarters, supplying sufficient resources is typically not a problem; however, when multiple calls occur simultaneously, units are committed to incidents for extended periods of time, or when insufficient resources exist to safely and effectively mitigate an emergency, further preparation and planning must be completed.

Call Concurrency

First, call concurrency is evaluated. Call concurrency is a comparison of how often multiple calls are occurring and placing additional demand on resources. In Figure 131, a concurrent call is identified when an in-service unit is dispatched to a separate incident prior to the first unit clearing the scene and becoming available. When two incidents are occurring simultaneously and a third separate incident is dispatched, three concurrent calls are present, and so on.

Figure 131. Call Concurrency (2017–2019)



Call Concurrency	
Single Incident	30.5%
2	34.6%
3	21.1%
4	9.1%
5	3.2%
6 or more	1.4%

When units are committed to an incident, only one incident is occurring 30.5% of the time. However, this also indicates that 69.5% of the time that units are committed at two or more separate incidents and are unavailable to respond to additional calls. When comparing these findings to the ERF analysis in the previous figure, Worcester's ability to provide a sufficient number of firefighters to the downtown area and center of the city the majority of the time appears to be adequate while response to outlying areas in the north, northwestern, and southeastern portions of the city possess the potential for delayed responses and insufficient personnel to safely and effectively mitigate medium or high-risk incidents.

Unit Hour Utilization

Another component that must be considered when evaluating Resource Reliability is Unit Hour Utilization (UHU). UHU provides an expression of the workload placed on the crew assigned to that unit and can also describe the amount of time that a unit is not available for response because it is already committed to another incident. The larger the percentage, the greater its utilization, and the less available it is for assignment to subsequent calls for service, training, and ancillary duties. UHU rates are expressed as a percentage of the total hours in a year.

In May 2016, Henrico County (VA) Division of Fire published an article after studying its department's EMS workload. As a result of the study, Henrico County Division of Fire developed a general commitment factor scale for its department. The next figure is a summary of the findings as it relates to commitment factors.

Figure 132. Commitment Factors as Developed by Henrico County (VA) Division of Fire, 2016

Factor	Indication	Description
0.16–0.24	Ideal Commitment Range	Personnel can maintain training requirements and physical fitness and can consistently achieve response time benchmarks. Units are available to the community more than 75% of the day.
0.25	System Stress	Community availability and unit sustainability are not questioned. First-due units are responding to their assigned community 75% of the time, and response benchmarks are rarely missed.
0.26–0.29	Evaluation Range	The community served will experience delayed incident responses. Just under 30% of the day, first-due ambulances are unavailable; thus, neighboring responders will likely exceed goals.
0.30	"Line in the Sand"	Not Sustainable: Commitment Threshold—the community has less than a 70% chance of timely emergency service and immediate relief is vital. Personnel assigned to units at or exceeding 0.3 may show signs of fatigue and burnout and may be at increased risk of errors. Required training and physical fitness sessions are not consistently completed.

In Figure 133, the UHUs of Worcester Fire Department units are displayed with their relative workloads from 2017 through 2019. While other units responded to incidents within the city during this time, their response activity levels were low, 1% or less, and not included in this figure.

Figure 133. Unit Hour Utilization, 2017–2019

Unit	Count	Average	90th Percentile	UHU	Sum
C3	5,955	0:12:46	0:23:53	3.6%	951:53:15
C4	5,637	0:13:43	0:27:03	3.7%	964:09:55
E2	9,424	0:12:39	0:22:05	5.7%	1495:05:45
E3	5,246	0:15:02	0:25:56	3.8%	995:15:06
E4	11,690	0:14:27	0:24:03	8.1%	2120:18:11
E5	9,876	0:16:45	0:27:08	7.9%	2070:03:48
E6	7,169	0:13:53	0:24:18	4.8%	1252:30:01
E7	5,289	0:16:34	0:27:54	4.2%	1102:18:49
E8	9,148	0:15:54	0:26:21	7.0%	1828:07:42
E9	4,981	0:18:44	0:28:44	4.4%	1153:57:02
E11	7,284	0:17:18	0:27:32	6.0%	1585:46:51
E12	7,406	0:14:05	0:25:50	4.9%	1297:13:58
E13	10,581	0:12:32	0:21:48	6.4%	1677:12:04
E15	5,989	0:16:50	0:27:42	4.8%	1263:15:58
E16	7,790	0:14:01	0:23:42	5.2%	1377:59:35
L1	4,439	0:14:25	0:27:29	3.0%	795:49:00
L2	4,509	0:14:22	0:27:35	3.0%	799:40:42
L3	4,651	0:13:39	0:25:39	3.1%	804:55:50
L4	3,309	0:17:12	0:30:26	2.7%	704:06:58
L5	2,014	0:17:40	0:35:02	1.7%	442:33:33
L6	3,088	0:17:19	0:30:35	2.6%	675:16:46
L7	4,498	0:15:04	0:27:53	3.2%	847:52:32
R1	4,581	0:13:26	0:26:18	3.0%	781:31:40

All units within the Worcester Fire Department system should possess the ability to be available for response at least 90% of the time. This is an important consideration as response performance is evaluated in the next section and the availability of units to respond within their respective districts impacts unit performance. Based on the UHUs calculated, Worcester crews should have sufficient time for training, pre-planning, and other duties throughout their shift.

Response Performance Summary

The most visible element of the Worcester Fire Department is its response performance. How quickly units arrive on the scene and the efficiency with which they resolve an emergency situation are typically the only interaction most residents will have with the fire department. To evaluate the fire department's performance, NFPA 1710 was used as it is the applicable standard for career fire departments.

Response time performance is comprised of the following components:

- **Call-Processing Time:** The amount of time between when a call is answered by the 911 Primary Public Safety Answering Point, or dispatch center, and when resources are dispatched.
- **Turnout Time:** The time interval between when units are notified of the incident and when the apparatus responds.
- **Travel Time:** The amount of time the responding unit actually spends on the road traveling to the incident until arrival at the scene. This is a function of speed and distance.
- **Response Time:** This time is calculated from the time the fire department is dispatched to the arrival of the first apparatus. Response Time equals the sum of "Turnout Time" and "Travel Time." Although this is a combination of Turnout and Travel Time, Response Time is the metric in which NFPA 1710 provides a performance standard.
- **Total Response Time:** This is the most apparent time to the caller requesting emergency services. Total response time is the amount of time that occurs from the time they place the emergency call until units arrive. This time often includes factors both within and outside the control of the fire department, particularly when another agency provides dispatch services.

Tracking the individual components of response time will enable Worcester to identify deficiencies and areas for improvement. Once department leadership understands the current performance for Call Processing, Turnout Time, and Travel Time, this information can be used to develop response goals and standards that are both relevant and achievable. Fire service best practices recommend that fire service organizations monitor and report the components of Total Response Time.

The Time Continuum is comprised of the three elements described above, Call-Processing, Turnout Time, and Travel Time. Total Response Time is the sum of all of the times starting with the call-processing time, turnout time, and travel time. The components of the Worcester Fire Department Response Time Continuum will each be evaluated in further detail in the next sections. The following figure is an illustration of the total response time continuum.

Figure 134. Total Response Time Continuum

Historically, fire rescue service providers have used the performance measurement of average response to describe the levels of performance. The average is a commonly used descriptive statistic, also called the mean of a data set. Averages may not accurately reflect the performance for the entire data set because the average can be significantly skewed by data outliers, especially in small data sets. One extremely good or bad value can skew the “average” for the entire data set. Percentile measurements are a better measure of performance since they show that most of the data set has achieved a particular level of performance. The 90th percentile means that 90% of responses were equal to or better than the performance identified, and that the other 10% can be attributed to data outliers, inaccurate data, or situations outside of normal operations that delayed performance. This can be compared to the desired performance objective to determine the degree of success in achieving the goal.

An important consideration when evaluating fractile performance is that the results of each category are not additive, meaning that the sum of two or more constituent metrics cannot be simply added together to find the sum. This is because each dataset is discrete and, as such, must be observed individually, particularly when data quality is an issue. If a metric such as response time possesses the majority of its data points, while turnout time is not accurately documented, a significant difference can exist between the response time calculated using the fractile descriptive and the sum of turn out time and travel.

In evaluating the various response time components using the fractile analysis method, each component must be evaluated and quantified separately, as the available data, and the quality of the data, may vary significantly.

To analyze the performance for emergency calls within Worcester, the following assumptions were made:

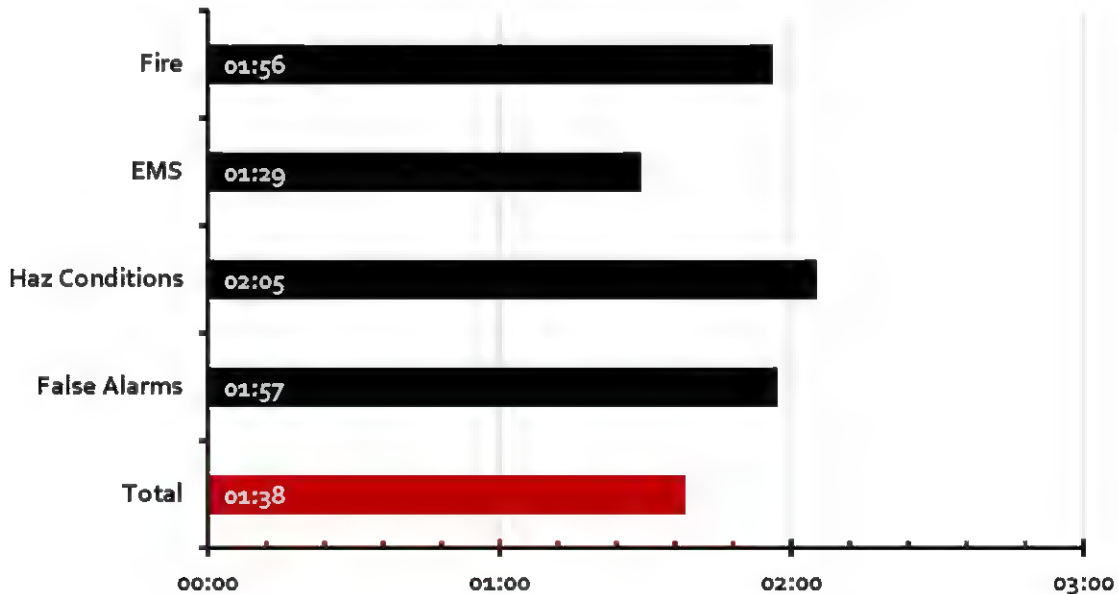
- Non-emergency incident types were removed.
- Mutual and auto aid given were removed.
- Other aid given was removed.
- NFIRS call types within the 500, 600, 800, and 900 series were removed.
- Cells containing zeros or no value were removed.

Call Processing Time Performance

The industry standard for call processing (or alarm handling) is NFPA 1221: *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*. This standard provides for communication centers to have processing times of not more than 60 seconds, 90% of the time. For special operations, calls requiring translation, or other factors described in the standard, times should not exceed 90 seconds at the 90th percentile.

Examination of Worcester's 2017–2019 data revealed that call processing time approached or exceeded the benchmark across categories when the communications center is examined. Data containing missing time stamps or zero-time stamps for call processing were not included.

Figure 135. Call Processing Time, 90th Percentile (2017–2019)



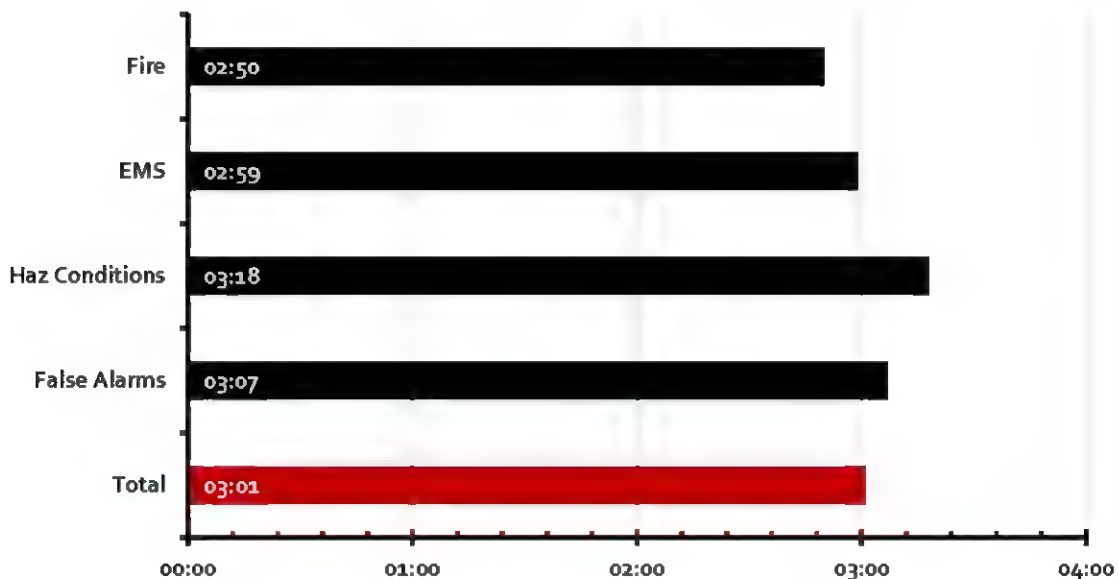
Call processing time performance approaches the NFPA 1710 standard of 64 seconds. Ideally, Worcester would meet or exceed this standard; however, it is ESCI's experience that most departments do not. At 1 minute, 38 seconds, Worcester's performance is strong when compared across the country; however, Worcester should continue to strive to meet industry standards.

Turnout Time Performance

The second component of the response continuum, and one that is directly affected by response personnel, is turnout performance. Turnout time is the time it takes personnel to receive the dispatch information, move to the appropriate apparatus, and begin responding to the incident.

NFPA 1710 calls for a 90th percentile turnout time performance of 80 seconds for fire and special operations calls and 60 seconds for EMS incidents. The following figure illustrates the turnout time performance for the Worcester Fire Department.

Figure 136. Turnout Time Performance, 90th Percentile (2017–2019)

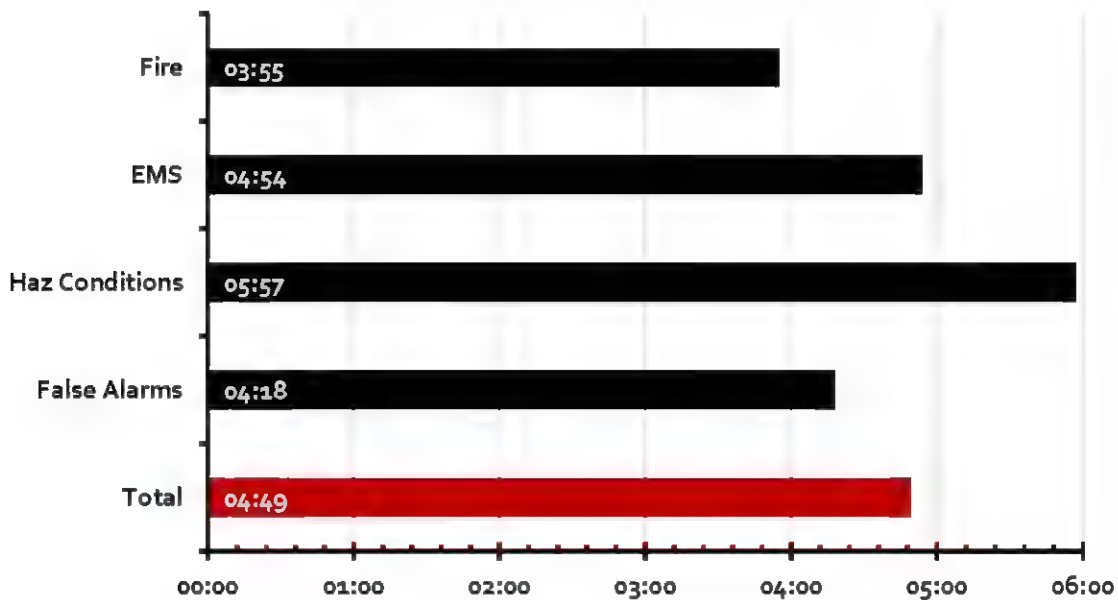


At nearly three times NFPA 1710 requirements, Worcester Fire Department should evaluate the delay in response after the initial notification. Worcester Fire Department should consider establishing a working group composed of members representing each rank within the operations division to determine the causes for turnout delays. Factors such as station configuration, the location of crew living quarters, cross staffing of apparatus, and delays resulting from relying on dispatchers to enter time stamps or forgetting to use the MDT are common factors in addition to non-compliance with policies or procedures. Once the contributing factors are identified, Worcester Fire Department should work to mitigate these delaying elements to the extent that it is possible, as well as provide regular updates for crew performance by unit, shift, station, and division.

Travel Time Performance

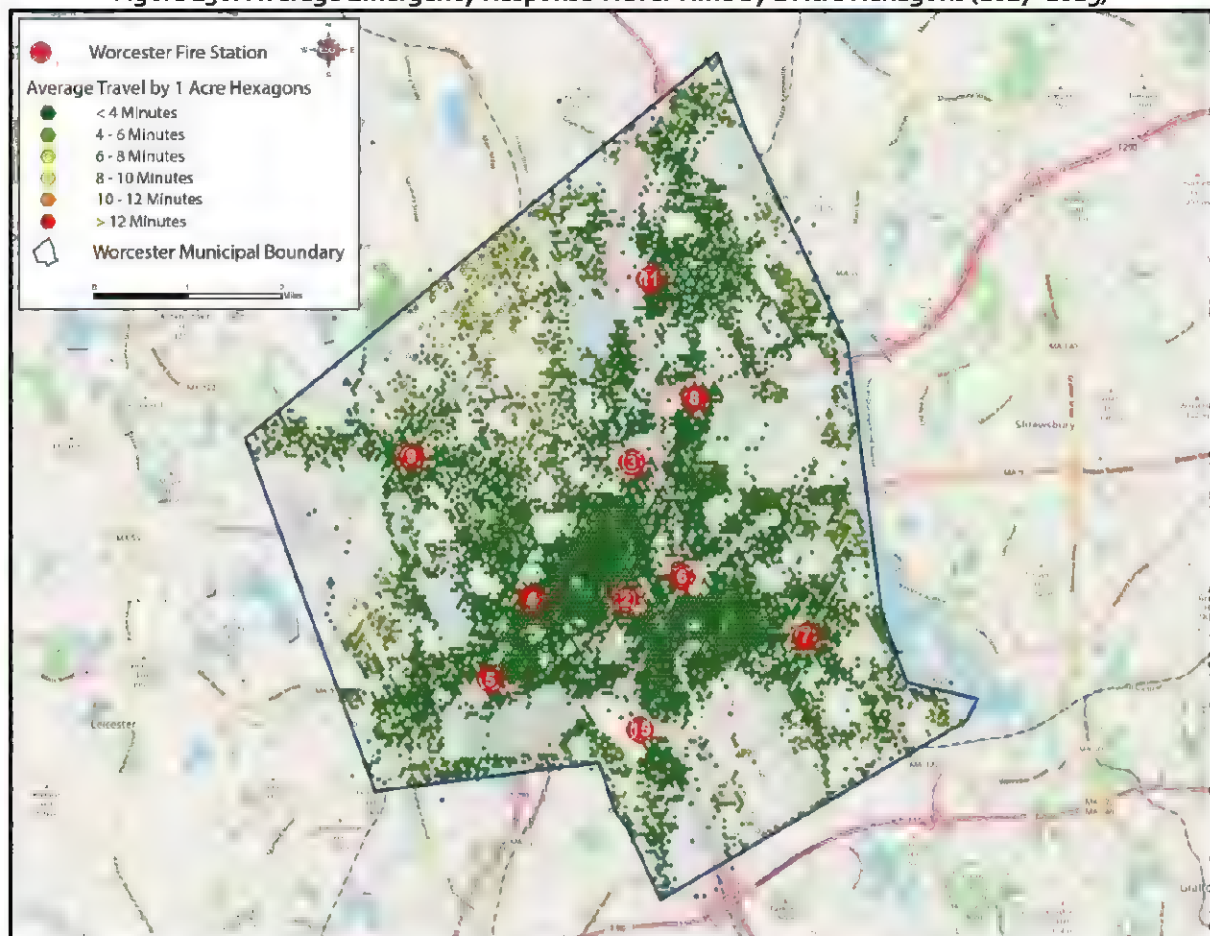
The third component of the response continuum is travel time. It is important to understand that travel time is not specifically a factor of speed as much as it is the result of proper placement of fire stations from which emergency response begins. Travel time is the amount of time between when the apparatus departs for the call and when it arrives on the scene and is measured at the 90th percentile. NFPA 1710 requires that the first due fire or EMS unit arrive on the scene within a 4-minute, or 240-second, travel time. The following figure provides the travel time performance for 2017 through 2019.

Figure 137. Travel Time, 90th Percentile (2017–2019)



Worcester Fire Department displays strong performance for travel time, with responses to fires exceeding NFPA 1710 standards. Overall, travel times at the 90th percentile are 49 seconds greater than industry standards; however, some incidents are likely known by responding crews as non-emergent calls, and therefore, the response is not as fast as true emergencies. Worcester Fire Department should consider identifying those calls that are true emergencies within their records management system and flagging outliers with a consistent quality assurance review process.

In Figure 138, WFD's travel performance is illustrated as 1-acre hexagons, with each providing the average travel time to that area. Not surprisingly, travel performance is best in areas immediately adjacent to fire stations.

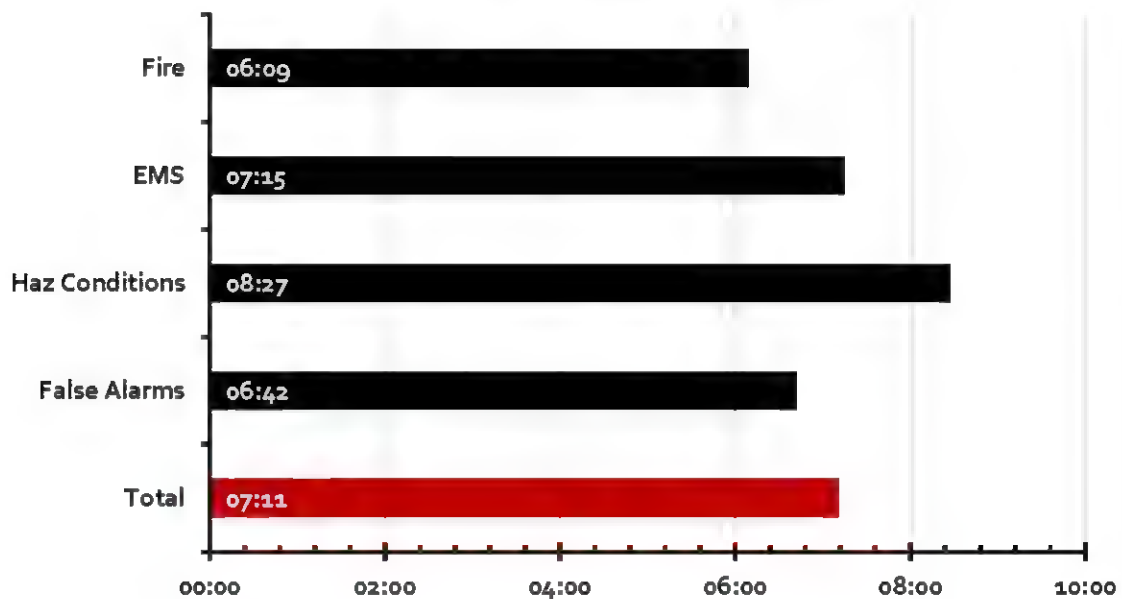
Figure 138. Average Emergency Response Travel Time by 1 Acre Hexagons (2017–2019)

When average travel times are examined geographically, most locations received travel times at or below 4 minutes. An area in the north of Worcester, between Main Street and Salisbury Street, lies outside of Worcester's current ability to respond within a 4-minute travel time. However, the call volume of this area should also be considered, and a cost-benefit analysis conducted prior to committing resources for coverage. Alternative options to fire stations include Quick Response Vehicles (QRVs), stand-by units, or interlocal agreements with neighboring fire departments.

Response Time Performance

Response time is the amount of time from initial notification to the fire department until the first unit arrives on-scene. While not specifically addressed by NFPA 1710, it is a combination of turnout and travel time standards of 5 minutes, 4 seconds for the majority of responses, and 5 minutes, 24 seconds for fire and special operations calls.

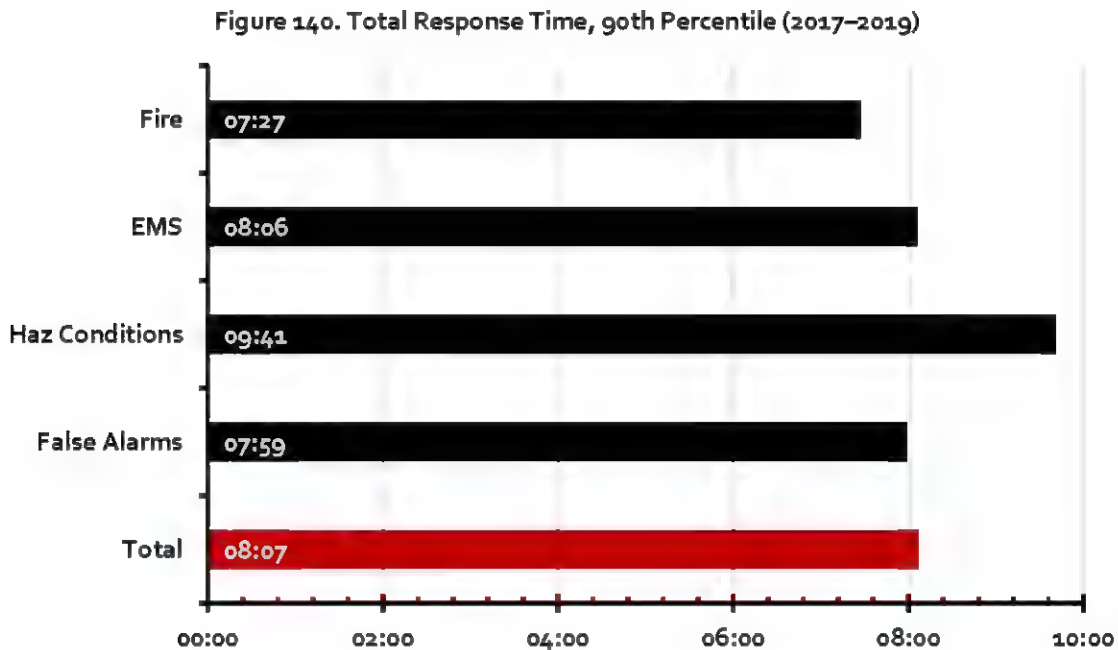
Figure 139. Response Time, 90th Percentile (2017–2019)



The impact of the delays in turnout is apparent when response times are compared with travel times. During this time period, the first Worcester Fire Department unit arrived on the scene for fires 6 minutes, 9 seconds after the initial notification at the 90th percentile, and overall, the first arriving unit was on the scene in 7 minutes, 11 seconds.

Total Response Time Performance

The culmination of the Response Time Continuum is total response time. When citizens call for emergency assistance, this metric represents what they experience as they place the call and wait for help to arrive. Total response time is the amount of time that elapsed from when the call was initiated at the communications center until the first emergency unit arrived on the scene. Like response time performance, NFPA 1710 does not provide a standard for this metric; however, it is presented here for informational purposes at the 90th percentile.

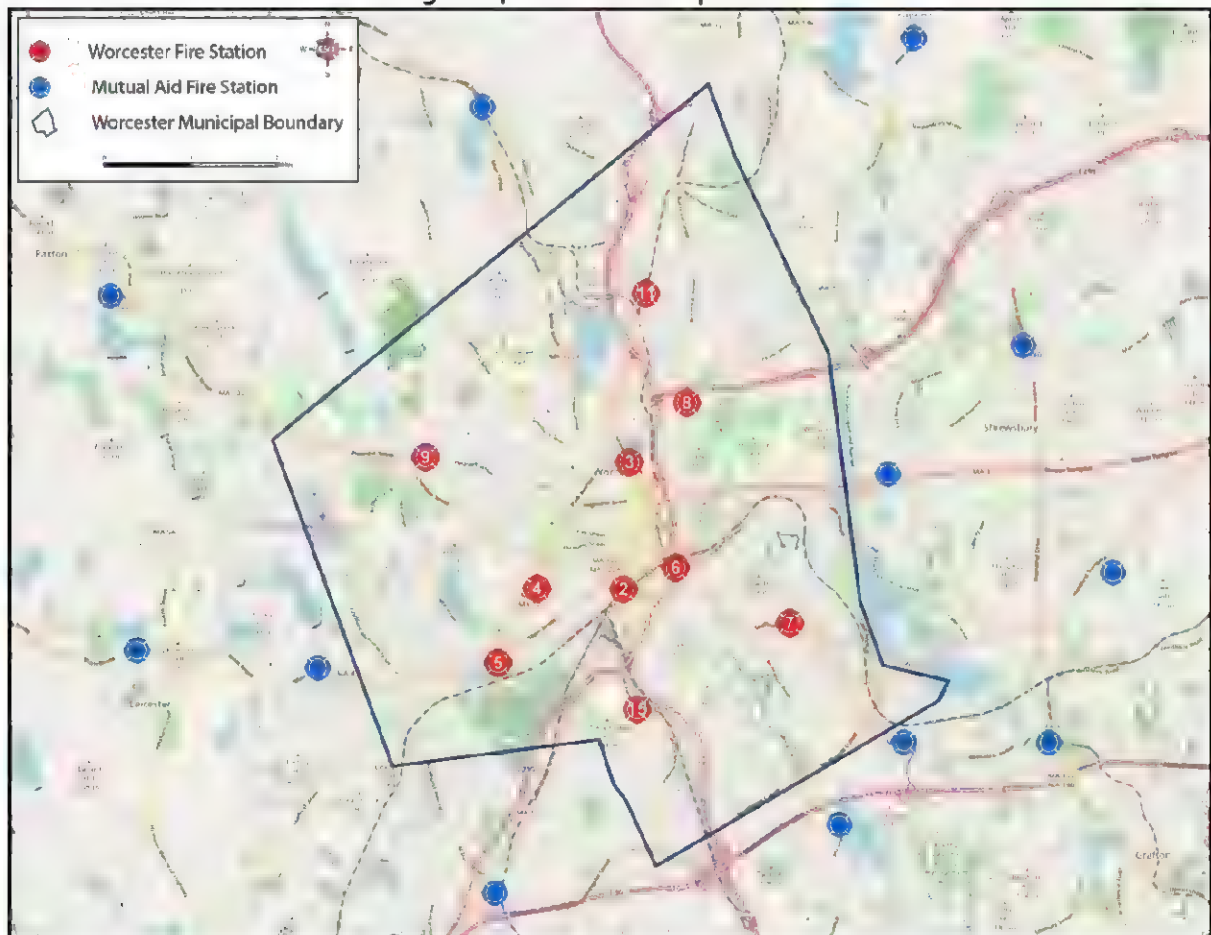


Overall, citizens can expect that they will receive a Worcester Fire Department unit within 8 minutes, 7 seconds or better 90% of the time. Most of the time in total response that was in excess of NFPA 1710 standards resulted from poor performance in turnout for all call types. All other metrics either approached or met industry standards.

Mutual & Automatic Aid Systems

Few, if any, organizations possess all the resources needed to mitigate all possible types of incidents. Additionally, when mutually beneficial agreements are possible, particularly when they occur at little cost to the organizations, good governance suggests that these opportunities should be seized to provide higher service levels to the communities involved. Two types of agreements are discussed in this section, mutual and automatic aid agreements. In mutual aid agreements, two or more organizations agree that, when requested, they will supply the other agency with the requested resources if they are available. For emergency services, this request typically occurs through the request on responding or on-scene personnel. The other type of agreement, automatic aid, occurs, as the name implies, automatically. When an emergency call is received by the dispatch center, all available resources are examined based on the appropriate unit type and their proximity to the call, typically with the closest unit responding regardless of the jurisdiction in which the incident occurred. The following figure presents the locations of Worcester Fire Department stations, as well as the locations of automatic aid fire stations within 3 miles of the municipal boundaries of Worcester.

Figure 141. Mutual Aid Departments



Departments that lie within a 3-mile distance of the City of Worcester are: Auburn, Boylston, Cherry Valley, Holden, Leicester, Millbury, North Grafton, Paxton, Shrewsbury, and West Boylston.

Future System Demand Projections

Understanding how the community is predicted to change in the future is an essential part of the planning process. Without some understanding of how Worcester's current levels of service will be affected over time, today's capital purchase and staffing deployment plans may or may not be adequate in future years. The types and intensity of change, where change occurs, and the amount of time these changes occur should all be considered in current planning and budgeting. In this section, future and projected development and their impact on population and demand for services are examined. First, a discussion on future planned projects within the City of Worcester is presented, followed by growth and service demand projections, and finally, a discussion on performance objectives.

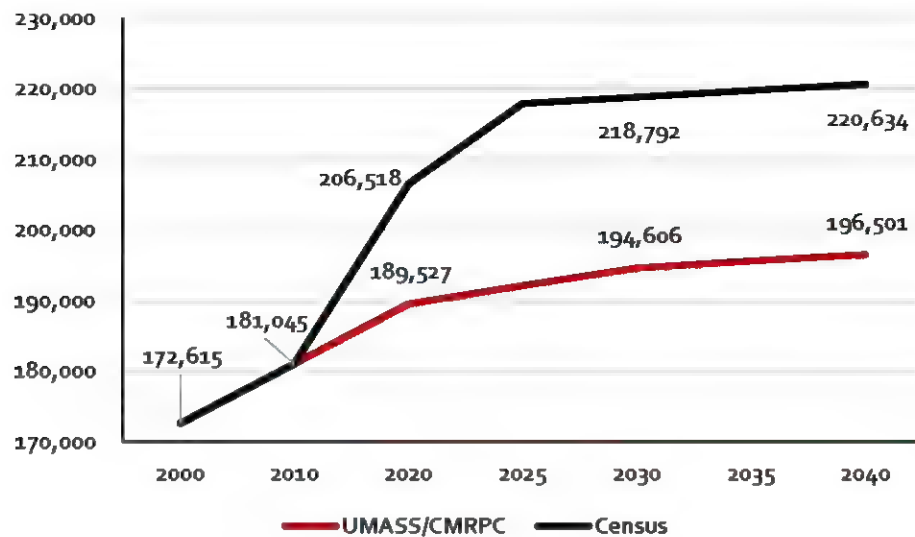
Major Development Projects

The City of Worcester has recently completed several large projects, with additional projects planned for the near future. Among those recently completed are the \$500 million CitySquare project that transformed the downtown area with luxury apartments, retail space, and a parking garage to service future hotels and restaurants. Additionally, the city has constructed a AAA minor league baseball park including adjacent hotels, mixed use residential, and retail space.

Finally, investments in the Worcester Regional Airport are expected to increase the number of flights available, both to and from the City of Worcester. With these projects on the horizon and more to come, the City of Worcester is poised to experience the revitalization of its downtown and added visitors and residents to the area.

Population Growth Projections

Populations and the rates at which they change fluctuate from year to year. Prior to the completion of this report, the US Census Bureau released the 2020 census results. Due to the large increase from the prior population estimates to the actual findings, this section was updated to reflect the latest information. Using US Census data, the rate of population increase for Worcester from 2000 to 2010 was 4.9% and from 2010 to 2020 was 14.1%, with an overall increase of 19.6% from the 20-year period resulting in an annual increase of 0.9%. American Community Survey population estimates predicted a reduction in annual growth from 2015–2020, and projections produced by the University of Massachusetts and the Central Massachusetts Regional Planning Commission (UMASS/CMRPC) and Esri followed this trend. Using the average annual growth for periods 2000 through 2010 of 0.9% and 2010 through 2020 at 1.3%, a 1.1% annual increase was applied to create a 20-year linear projection based on 2020 population totals. In the following figure, this projection is compared with the projections published in 2018 by UMASS/CMRPC, which indicated a reduced growth pattern for the city and the area.

Figure 142. Historical Population and Future Projections for Worcester, MA

Moving forward from 2020, the linear projection produced a 6.8% population increase by 2040, while the model developed by UMASS/CMRPC predicts a 3.7% increase. In either case, the population of Worcester is expected to remain stable or moderately increase throughout the foreseeable future.

Many factors can influence how quickly or slowly a population will change over time. Additionally, the demographic makeup of future populations will influence the demand for services. Next, ESCI provides future service demand projections based on population estimates.

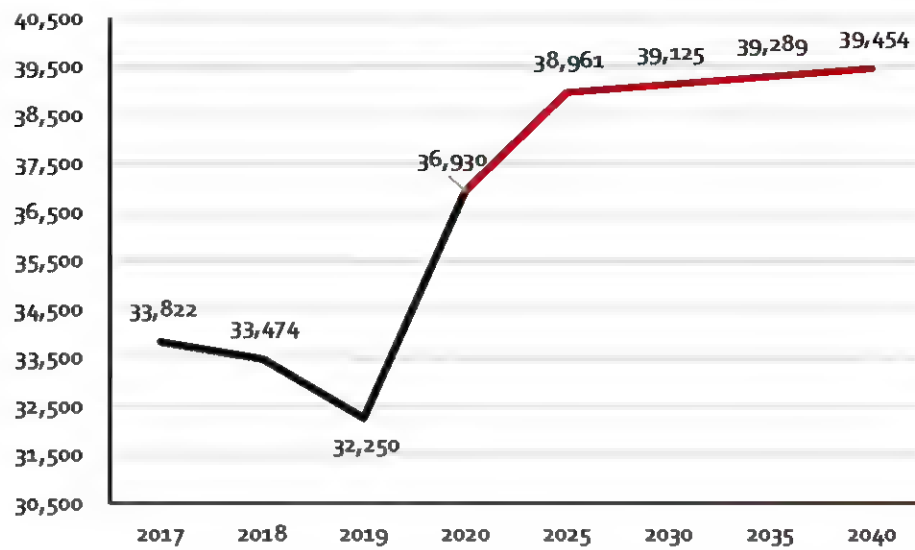
Service Demand Projections

Demand for services is often tied to the size of the population served. Other factors such as age, access to medical care, general health, and economic stability can all influence how frequently emergency services are requested.

In Worcester, the average per capita rate of service demand from 2017 through 2019 was 178.8 incidents per 1,000 with an upper range of 182.1 in 2017 (meaning an increase in calls for the total number of people) and a low end of 173.9 in 2019 (meaning a decrease in calls for the total number of people).

In Figure 143, service demand projections are provided using the average per capita rate of demand for 2017 through 2018 of 4.4. A high end of 4.0 per capita was found in 2018 and a low end of 4.7 per capita in 2019.

Figure 143. Projected Service Demand (2020–2040)



The impact of the COVID-19 pandemic on emergency services in 2020 resulted in a decrease in service demand for most fire departments across the nation, particularly during the heavy quarantine period from March through June of that year. Moving forward, new trends may emerge as many realize the potential capabilities of remote conferencing while others may remain leery about going to emergency rooms or gathering in large groups. Worcester Fire Department should continue to monitor its demands for services to ensure the expectations of the community are met.

Establishment of Performance Objectives

There are three main factors that lead to successful mitigation of emergencies: sufficient numbers of well-trained *personnel*, arriving on reliable and well-equipped *apparatus* appropriate to the task at hand, *quickly enough* to make a positive difference in property preserved or lives saved.

The previous sections of this report have laid out the current staffing levels, facilities and equipment, and response performance for the Worcester Fire Department. The following describes the consequences of failing to deliver sufficient personnel and equipment early enough to mitigate the emergency addressed.

Dynamics of Fire in Buildings

Most fires within buildings develop in a predictable fashion unless influenced by highly flammable material. Ignition, or the beginning of a fire, starts the sequence of events. It may take several minutes or even hours from the time of ignition until a flame is visible. This smoldering stage is very dangerous, especially during times when people are sleeping, since large amounts of highly toxic smoke may be generated during this phase.

Once flames do appear, the sequence continues rapidly. Combustible materials adjacent to the flame heat and ignite, which in turn heats and ignites other adjacent materials if sufficient oxygen is present. As the objects burn, heated gases accumulate at the ceiling of the room. Some of the gases are flammable and highly toxic.

The spread of the fire from this point continues quickly. Soon the flammable gases at the ceiling as well as other combustible material in the room of origin reach ignition temperature. At that point, an event termed “flashover” occurs; the gases and other material ignite, which in turn ignites everything in the room. Once flashover occurs, damage caused by the fire is significant and the environment within the room can no longer support human life. Flashover usually occurs about five to eight minutes from the appearance of flames in typically furnished and ventilated buildings. Since flashover has such a dramatic influence on the outcome of a fire event, the goal of any fire agency is to apply water to a fire before flashover occurs.

Although modern codes tend to make fires in newer structures more infrequent, today’s energy-efficient construction (designed to hold heat during the winter) also tends to confine the heat of a hostile fire. In addition, research has shown that modern furnishings generally ignite more quickly and burn hotter (due to synthetics). In the 1970s, scientists at the National Institute of Standards and Technology found that after a fire broke out, building occupants had about 17 minutes to escape before being overcome by heat and smoke. Today, that estimate is as short as three minutes.⁵⁵ The necessity of effective early warning (smoke alarms), early suppression (fire sprinklers), and firefighters arriving on the scene of a fire in the shortest span of time is more critical now than ever.

⁵⁵ *National Institute of Standards and Technology, Performance of Home Smoke Alarms, Analysis of the Response of Several Available Technologies in Residential Fire Settings, Bukowski, Richard, et al.*

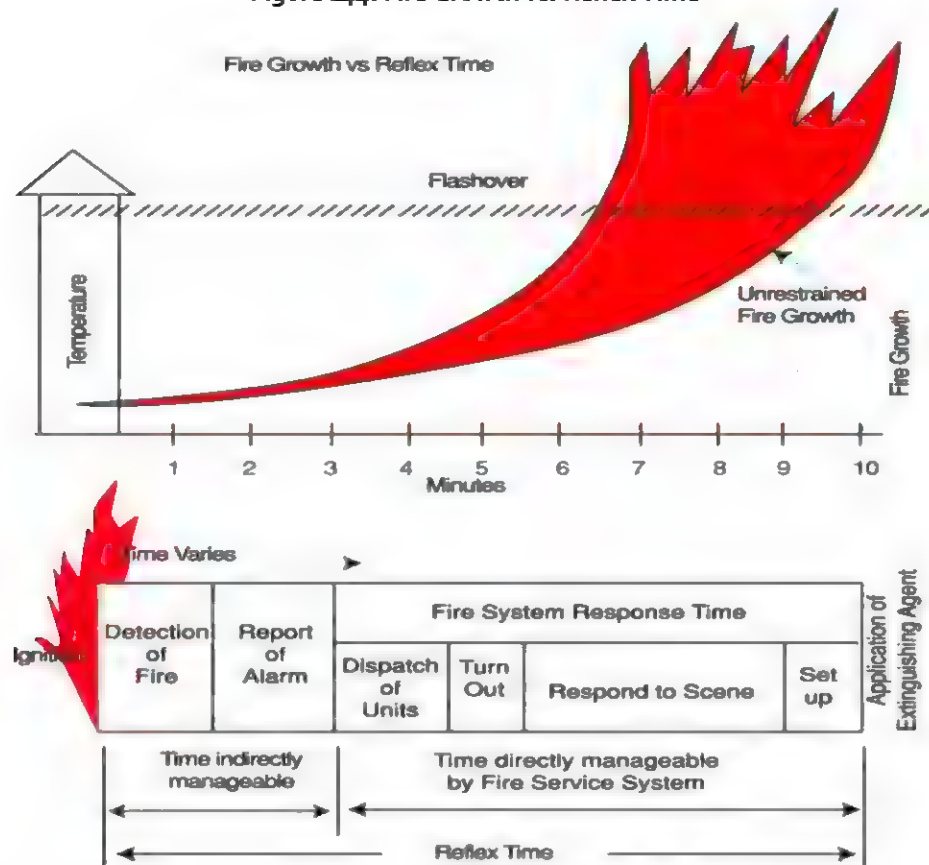
The prompt arrival of at least four personnel is critical for structure fires. Federal regulations (CFR 1910.120) require that personnel entering a building involved in fire must be in groups of two. Further, before personnel can enter a building to extinguish a fire, at least two personnel must be on scene and assigned to conduct search and rescue in case the fire attack crew becomes trapped. This is referred to as the two-in, two-out rule. However, if it is *known* that victims are trapped inside the building, a rescue attempt can be performed without additional personnel ready to intervene outside the structure. Further, there is no requirement that all four arrive on the same response vehicle. Many fire departments rely on more than one unit arriving to initiate interior fire attack.

Perhaps as important as preventing flashover is the need to control a fire before it does damage to the structural framing of a building. Materials used to construct buildings today are often less fire-resistive than the heavy structural skeletons of older frame buildings. Roof trusses and floor joists are commonly made with lighter materials that are more easily weakened by the effects of fire. “Light weight” roof trusses fail after five to seven minutes of direct flame impingement. Plywood I-beam joists can fail after as little as three minutes of flame contact. This creates a dangerous environment for firefighters.

In addition, the contents of buildings today have a much greater potential for heat production than in the past. The widespread use of plastics in furnishings and other building contents rapidly accelerates fire spread and increases the amount of water needed to effectively control a fire. All of these factors make the need for early application of water essential to a successful fire outcome.

The next figure illustrates the sequence of events during the growth of a structure fire over time.

Figure 144. Fire Growth vs. Reflex Time



As is apparent by this description of the sequence of events, the application of water in time to prevent flashover is a serious challenge for any fire department. It is critical, though, as studies of historical fire losses can demonstrate.

The National Fire Protection Association found that fires contained to the room of origin (typically extinguished prior to or immediately following flashover) had significantly lower rates of death, injury, and property loss when compared to fires that had an opportunity to spread beyond the room of origin (typically extinguished post-flashover). As evidenced in the following figure, fire losses, casualties, and deaths rise significantly as the extent of fire damage increases.

Figure 145. Fire Extension in Residential Structures, United States, 2011–2015

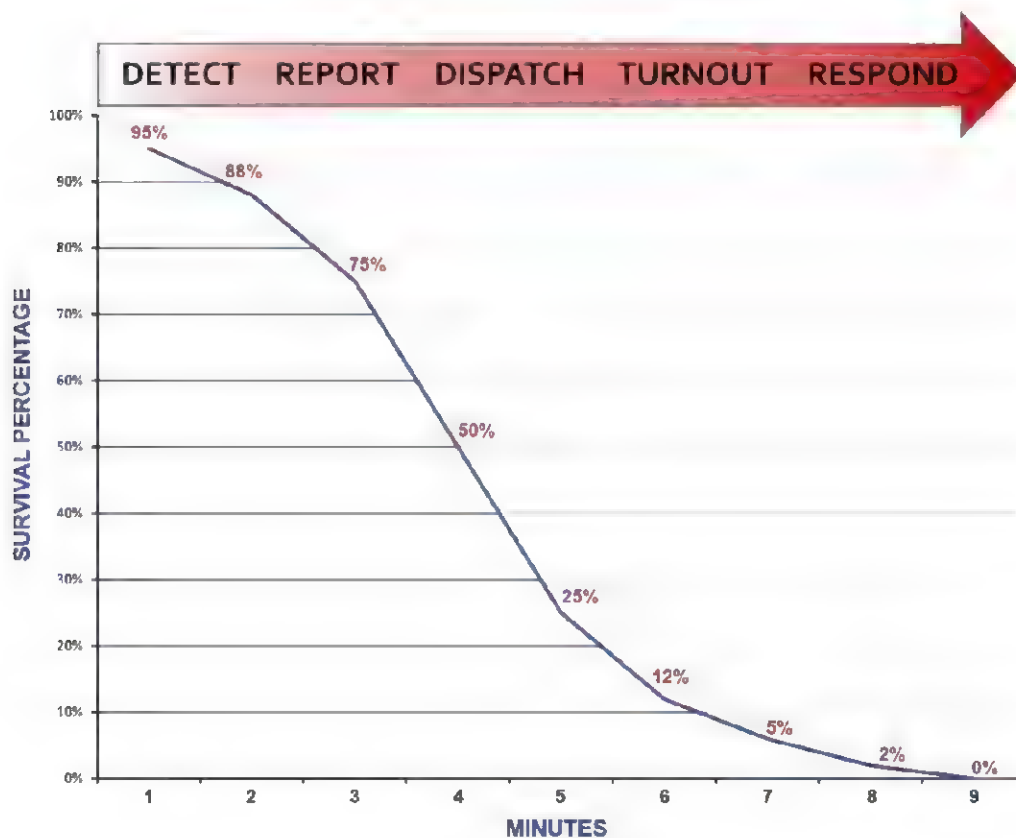
Fire Extension	Rates per 1,000 Fires		
	Civilian Deaths	Civilian Injuries	Average Dollar Loss Per Fire
Confined to room of origin or smaller	1.8	24.8	\$4,200
Confined to floor of origin	15.8	81.4	\$36,300
Confined to building of origin or larger	24.0	57.6	\$67,600

Source: National Fire Protection Association

Emergency Medical Event Sequence

Cardiac arrest is the most significant life-threatening medical event in emergency medicine today. A victim of cardiac arrest has mere minutes in which to receive lifesaving care if there is to be any hope for resuscitation. The American Heart Association (AHA) issued a set of cardiopulmonary resuscitation guidelines designed to streamline emergency procedures for heart attack victims, and to increase the likelihood of survival. The AHA guidelines include goals for the application of cardiac defibrillation to cardiac arrest victims. Cardiac arrest survival chances fall by 7 to 10% for every minute between collapse and defibrillation. Consequently, the AHA recommends cardiac defibrillation within five minutes of cardiac arrest. As with fires, the sequence of events that lead to emergency cardiac care can be graphically illustrated, as in the following figure.

Figure 146. Cardiac Arrest Event Sequence



The percentage of opportunity for recovery from cardiac arrest drops quickly as time progresses. The stages of medical response are very similar to the components described for a fire response. Recent research stresses the importance of rapid cardiac defibrillation and administration of certain medications as a means of improving the opportunity for successful resuscitation and survival.

People, Tools, and Time

Time matters a great deal in the achievement of an effective outcome to an emergency event. Time, however, is not the only factor. Delivering sufficient numbers of properly trained appropriately equipped personnel within the critical time period completes the equation.

For medical emergencies this can vary based on the nature of the emergency. Many medical emergencies are not time critical. However, for serious trauma, cardiac arrest, or conditions that may lead to cardiac arrest, a rapid response is essential. Equally critical is delivering enough personnel to the scene to perform all of the concurrent tasks required to deliver quality emergency care. For a cardiac arrest, this can be up to six personnel; two to perform CPR, two to set up and operate advanced medical equipment, one to record the actions taken by emergency care workers, and one to direct patient care. Thus, for a medical emergency, the real test of performance is the time it takes to provide the personnel and equipment needed to deal effectively with the patient's condition, not necessarily the time it takes for the first person to arrive.

Critical Tasks, Risk, and Staffing Performance

The goal of any fire service organization is to provide adequate resources within a period of time to reasonably mitigate an emergency event. However, all emergency events inherently carry their own set of special circumstances and will require varying levels of staffing based upon factors surrounding the incident. Properties with high fire risk often require greater numbers of personnel and apparatus to effectively mitigate the fire emergency. Staffing and deployment decisions should be made with consideration of the level of risk involved. Common risk categories used in the fire service are:

- **Low Risk:** Areas and properties used for agricultural purposes, open space, low-density residential, and other low intensity uses.
- **Moderate Risk:** Areas and properties used for medium density single family residences, small commercial and offices uses, low intensity retail sales, and equivalently sized business activities.
- **High Risk:** Higher density businesses and structures, mixed use areas, high density residential, industrial, warehousing, and large mercantile structures.

Fire emergencies are even more resource critical. Again, the true test of performance is the time it takes to deliver sufficient personnel to initiate the application of water to a fire. This is the only practical method to reverse the continuing internal temperature increases and ultimately prevent flashover. The arrival of one person with a portable radio does not provide fire intervention capability and should not be counted as "arrival" by the fire department. The *Management and Staffing* section of this report detailed the NFPA 1710 critical tasks expected to be performed by firefighters concurrently, referred to as the "effective response force" (ERF) and compared that to the number of Worcester firefighters that are initially deployed for structure fires.

Response Time Performance Objectives

To initiate the process of developing performance objectives, several items must be considered. Although the specific information needed to complete this process will vary with each organization, the following items will generally need to be addressed during this process. Historical call data must be collected and analyzed to determine current performance baselines and identify any gaps in data required; response zones must be established based on agreed-upon criteria (i.e., population zones, geographic boundaries, etc.); and benchmarks established as goals for these demand zones.

Current Response Goals

ESCI emphasizes the importance of establishing and regularly monitoring performance metrics for the deployment of resources. These metrics serve as the foundation for determining whether or not the organization is meeting the expectations of the community that it serves. Without regular and consistent performance evaluation, it is impossible to set and achieve goals established to meet community expectations.

Response standards established by the department must originate from the community served to create a balance between what is desired and what can be afforded. Because of this, ESCI cannot establish baseline and benchmark performance metrics for a given organization. However, recommendations based upon the analysis conducted throughout this report may be helpful in serving as a starting point for these discussions with the community served or may serve as a reevaluation tool for the organization's current standards.

Response standards are individual to each organization. Multiple factors such as staffing, financial constraints, size of the service area, and political will influence each department's ability to set achievable goals and objectives for response.

Opportunities and Recommendations

ESCI has identified ten *Opportunities to Change the Worcester Fire Department Culture*. These opportunities should be used as the foundation of a Long-Term Strategy for the future success of the Worcester Fire Department.

Within each of the ten identified *Opportunities to Change the Worcester Fire Department Culture*, ESCI has further identified multiple specific *Recommendations* that could be implemented to capitalize on the Opportunity.

Opportunity 1: Fire Department Leadership Team

The Worcester Fire Department requires immediate intervention. It is ESCI's strong recommendation that the Worcester Fire Department create a temporary Assistant City Manager or Fire Commissioner position that is specifically tasked with overseeing all Fire Service Operations. The placement of this position within the City Manager's Office will ensure that the required changes are made in concert with the direction of the City Manager. ESCI further suggests that when the current Fire Chief retires, that the Chief Position remains vacant, and the Assistant City Manager or Fire Commissioner of Fire Service Operations be named interim Fire Chief until such time that there is a qualified candidate for Fire Chief within the Worcester Fire Department.

The ideal candidate for the temporary position of Assistant City Manager or Fire Commissioner tasked with overseeing all Fire Service Operations would be an experienced Fire Chief with a proven track record as a change agent. This individual should be familiar with the traditions of the New England Fire Service, be a willing and eager mentor, and possess outstanding communication and organizational skills.

Recommendation 1.1: When the current Fire Chief retires, the Chief position should remain vacant until such time that there is a qualified candidate for Fire Chief within the Worcester Fire Department.

The Worcester Fire Department has some very capable people within its organization. The city would not be setting them up for success as the next Chief of the Worcester Fire Department if anyone within the organization were to be promoted to Chief without the organization first being stabilized. The time it takes to stabilize the organization could also be used for professional development to better prepare members of the organization to be the next Chief.

Recommendation 1.2: Increase Administrative Staffing.

The Worcester Fire Department's administrative functions are led by the Fire Chief and supported by two Deputy Chiefs, a District Chief, and five civilian positions for a total of nine full-time equivalent (FTE) positions. This represents 2% of the department's total staffing of 392 full-time positions. It is ESCI's experience that effective administrative staffing totals for municipal fire department operations typically range from 12 to 15% of agency totals. After reviewing the functions and responsibilities assigned to the workgroup, ESCI concluded that the number of FTE assigned resides in the extreme

lower range of the normally experienced administrative levels to support the responsibilities of the Worcester Fire Department's administration appropriately.

ESCI suggests that the addition of the following administrative positions could benefit the Worcester Fire Department:

- **Deputy Chief of Internal Affairs:** The addition of this position would remove this work from the Chief and existing Deputy Chief of Administration as both of those positions have a much wider scope of responsibility. The single point of contact within the fire department will better position the Worcester Fire Department to address personnel issues more consistently and to hold members accountable as appropriate.
- **Additional Safety Division Staff:** There is a need to determine what firefighter injury data should be collected, analyzed, and used for the betterment of the Worcester Fire Department. This Data Analyst position could be a civilian position. The assignment of a Firefighter to this Division to assist with the development of policies, programs and procedures would also strengthen the Safety Division as well as create a Professional Development Opportunity for Worcester Firefighters.

Additional staff that can be considered as Administrative (as their primary role is not to respond to emergency services calls) are addressed in *Opportunity 5: Training* and, also in *Opportunity 9: Support Services Staffing*. The Worcester Fire Department also has a need for additional positions in both the Training and Fire Prevention Divisions.

Opportunity 2: Communication Network

Communication is a major deficiency within the Worcester Fire Department. It is imperative that a Fire Department Communication Plan be designed that identifies what information will be shared with specific ranks of personnel within the department and by what means.

Recommendation 2.1: Design and implement a Department-wide Communication Plan.

Communication is a common issue for many organizations and is a major deficiency within the Worcester Fire Department. It is imperative that a Fire Department Communication Plan be designed and implemented. The plan must identify the information to be shared with various and specific ranks of personnel within the department and by what means.

The Communication Plan must then be implemented and consistently followed. The implementation of a Communications Plan manages the expectations of the membership within the Worcester Fire Department as it relates to the type and quantity of information personnel will receive. This allows for personnel to know where to direct questions they may have related to programs, policies, or other events within the Worcester Fire Department.

Recommendation 2.2: Release the Board of Inquiry Reports.

The Worcester Fire Department should release the Board of Inquiry reports immediately to allay field concerns of actions being repeated that could lead to the next line of duty death. This act could also serve as a trust builder between the Administration and Field Operations Personnel.

Recommendation 2.3: Adopt Mission, Vision, and Values Statements.

ESCI recommends that after the Worcester Fire Department adopts Mission, Vision, and Values Statements, the fire department further commits to reviewing and updating these statements as the fire department evolves to ensure that these management components accurately reflect the current organization and the service demand from the community.

Recommendation 2.4: Provide more community outreach to engage the residents and business owners within the City of Worcester.

In general, the people who participated in the External Customer Assessment Survey valued the service that is offered by the fire department. Survey participants used the words “always there for us,” “loved,” and “professional” to describe their firefighters. Both residents and business owners expressed repeated concerns about the health and safety of their firefighters, specifically as it relates to preventing line of duty firefighter deaths. The work done by the men and women of the Worcester Fire Department has not gone unnoticed by their community.

ESCI notes that, while in many cases, the survey respondents were very well-versed about fire service industry standards and best practices, there were also multiple requests throughout the surveys for additional information about the fire department and its operations. ESCI suggests that this indicates interest among both the residents and business owners to know more about the operations of their fire department in an effort to ensure that firefighters have the necessary resources to safely perform their jobs. This presents an opportunity for the Worcester Fire Department to provide more community outreach to engage the residents and business owners within the City of Worcester.

Opportunity 3: Chain of Command

The Chain of Command must be clearly articulated and consistently enforced within the Worcester Fire Department.

Recommendation 3.1: Review and update as necessary the Chain of Command. Department leaders should then be held accountable for consistently following the Chain of Command.

The Chain of Command must be clearly identified, articulated, and consistently enforced within the Worcester Fire Department. Ensure each initiative rolled out includes a detailed explanation of “the why.” The Administration needs to insist members within the chain of command own direction passed down from above as their own. Pawning off initiatives as “...what they want...” abdicates the messenger’s authority and contributes to confusion at the operations level and distrust among the rank and file. Additionally, the city should evaluate the benefits of establishing an overall shift supervisor for each shift that is either in a different bargaining unit or unrepresented. Further, the city should explore the potential benefits of having supervisory positions above a certain rank in a different bargaining unit than line personnel whom they supervise.

Recommendation 3.2: Review and update as necessary the current fire department administration’s “Open Door Policy.”

The Leadership of the Worcester Fire Department reported to ESCI that they maintain an open-door policy that allows members of the fire department to talk to the Chiefs about anything at any time. While, in concept, this could be viewed as an effort to improve communications, special attention must be given to make sure that this policy does not lead to Chain of Command violations and opportunities to undercut company officers.

Opportunity 4: Rules & Regulations and Guidelines

The use of Rules, Regulations, Policies, and Standard Operating Procedures and Guidelines are industry best practice and defined by NFPA 1710 as “A written organizational directive that establishes or prescribes specific operational or administrative methods to be followed routinely for the performance of designated operations or actions” and are to be used for managing emergency and non-emergency incidents or functions.

Recommendation 4.1: Make it a priority to update the Rules and Regulations as well as the Guidelines.

ESCI’s review of Worcester’s *Rules and Regulations* and its *Guidelines* revealed a series of sections in both documents that are outdated, not in compliance with industry standards or best practices, and in direct conflict with other current Worcester Fire Department *Rules and Regulations, Guidelines*, or current practices.

The Worcester Fire Department must make it a priority to update its *Rules and Regulations* as well as its *Guidelines*. The recommendations made in the National Institute for Occupational Safety and Health (NIOSH) Line of Duty Death Reports specific to the firefighter line of duty deaths in Worcester should be a focus of this update.

Each company should possess a predetermined assignment prior to arriving on the scene, as well as a thorough understanding of company assignments for other arriving units based upon the order of arriving or as directed by the incident commander.

Scene accountability must be maintained at all times using a system that prevents responders from entering an environment that could be Immediately Dangerous to Life or Health (IDLH). This includes accounting for each individual firefighter, their rank, position on the apparatus, company, and assignment on the fireground prior to engaging in suppression activities using a recognized accountability system. Equipment placement on apparatus should be standardized. The Worcester Fire Department does not currently have a system that accomplishes this requirement. Currently, the department is actively working to correct these issues; however, basic incident command training, such as the National Incident Management System (NIMS) Training provided online by the Federal Emergency Management Agency (FEMA), must be accomplished by all members of the department.

Consequences for violating company assignments and breaching company integrity on scene must be clearly communicated, implemented, and sustained.

Recommendation 4.2: Develop a current Code of Conduct Standard.

The Code of Conduct should establish what constitutes professionalism in the Worcester Fire Department. This Code should be published and maintained as the bar for all to exhibit.

Individual, team, and organizational expectations for performance require accountability at all levels should be established and clearly understood by all personnel. The Code of Conduct should further emphasize the importance of personal accountability for all members to themselves, their work group, the department, and the community.

Opportunity 5: Training

The Worcester Fire Department must take steps to stabilize the Training Division, including succession planning and quality assurance programs to ensure that all recruit classes are consistently held to the same high standards. There is no consistency within the Training Division. Firefighters are routinely assigned in and out of the Training Division as instructors. Depending on the personnel assigned to the division at any given time, the quality and duration of an initial firefighter recruit program can vary greatly.

When the Training Division is running an initial firefighter recruit program, incumbent firefighter training is suspended. This is a disservice to the entire Worcester Fire Department. Immediate steps should be taken to add personnel to the Training Division to allow for simultaneous training of both incumbent and recruit firefighters. Alternatively, the Worcester Fire Department should consider outsourcing the training of recruit firefighters to the Massachusetts Firefighting Academy to allow the Worcester Training Division to focus its resources on incumbent firefighter training.

Recommendation 5.1: The Worcester Fire Department must take steps to stabilize the Training Division.

Succession planning and quality assurance programs must be developed, implemented, and sustained to assure that all recruit classes are consistently held to the same high standards. These training and performance standards should be transitioned to and upheld at the station level.

Recommendation 5.2: Ensure that incumbent firefighter training is provided throughout the year—even when there is a Recruit School in progress.

Year-round training for incumbent firefighters can be ensured through any number of paths:

- Additional personnel could be added to the Training Division to allow for simultaneous recruit and incumbent firefighter training.
- The Worcester Fire Department should investigate the feasibility of outsourcing recruit training to the Massachusetts Fire Academy, which can be provided at no cost to the City of Worcester.

Recommendation 5.3: Reconfigure the Training Division to better manage the training and mentoring of new firefighters.

Training new firefighters is an ongoing, year-round process for the Worcester Fire Department. Having a full-time staff member that is dedicated to drill school training and probationary development and monitoring is critical to the success of establishing a strong foundation of trained firefighters in the organization.

An Officer in Charge of Recruit Training, preferably at the rank of Captain, and two full-time personnel, preferably at the rank of Lieutenant, is recommended. This cadre should be augmented by the four (4) additional personnel during Drill School. Additionally, a Captain OIC for Inservice Training should be established, possibly utilizing the incumbent. The Inservice Training Section would maintain the Lieutenant and Firefighter positions. Lastly, a civilian administrative position should be established that would be responsible for the VA issues, recertification filing, and the Narcan grant. This suggested structure would require two (2) additional uniformed positions and one (1) civilian position.

Recommendation 5.4: Training drills and refreshers should be predetermined and developed by the Training Division.

Training drills and refreshers should be predetermined and developed by the Training Division and completed through a combination of company training completed by on-duty officers with their crews and instructor-led facilitation as part of multi-company training, annual skill refreshers, and competency for job task requirements by position. This would assure current and uniform training throughout the department.

Recommendation 5.5: Each shift should be assigned an on-duty Training Officer to serve as the liaison between operations and the Training Division.

On-duty Training Officers should be available to crews, trained to conduct quality assurance while on emergency scenes, and be immediately available to conduct After Action Reports or Critical Incident Stress Debriefings. The assignment of this position to shift work may make it more appealing to members of the fire department who are not interested in working straight days, thus allowing for a more competitive process to fill these positions.

Recommendation 5.6: A policy should be developed clearly articulating that each employee is responsible for completing all training requirements assigned to them and that all supervisors are directly responsible for ensuring that training assignments are satisfactorily completed by all employees reporting to them.

All members should be held accountable for completing all training requirements. The Training Division will produce the assignments and assist in assessments or remedial training. Supervisors will ensure that training requirements are met.

Recommendation 5.7: Develop an Annual Training Program that is communicated to all members at the start of every year.

The following training requirements can assist in the development of an annual training plan for the entire department:

- One of the leading causes of firefighter injuries and deaths every year is from vehicle accidents. Specifically, accidents involving fire rescue apparatus. The safe and efficient operation of these vehicles is dependent on a structured introductory qualification program and an ongoing annual refresher training program for those apparatus operators deemed qualified. NFPA 1002: *Standard for Fire Apparatus Driver/Operator Professional Qualifications* provides nationally accepted, peer-reviewed standards for initial and ongoing training programs.
- As an Insurance Services Office (ISO) rated department, each firefighter, driver/operator, and officer, as applicable, must complete the following numbers of hours annually:
 1. 18 hours of facility training per year
 2. 16 hours per month company-level training
 3. 12 hours of officer development training for all officers
 4. 12 hours of driver training for anyone qualified as a driver/operator
(It is required to have 60 hours of initial training to qualify as a driver/operator)
 5. 6 hours of hazardous materials training
- Following the department-wide certification in the Blue Card system, an annual incident command training program must be implemented to ensure the sustainability of a strong and established incident command system.

- NFPA 1410: *Standard on Training for Emergency Scene Operations* provides numerous training scenarios that could be used at the company level to reinforce the knowledge, skills, and abilities of the firefighter.
- The Worcester Fire Department Training Division should review NFPA 1402: *Standard on Facilities for Fire Training and Associated Props* to ensure all buildings, props, and other training aids are in compliance with this national standard.
- All live fire training activities conducted by the Training Division should be done in accordance with NFPA 1403: *Standard on Live Fire Training Evolutions*. Qualified individuals should be assigned to key positions and an acceptable instructor/student ratio maintained during each evolution.

Recommendation 5.8: Integrate outside instructors into the Worcester Fire Department Training Program.

The use of instructors from outside of the Worcester Fire Department is critical to the future success of the Worcester Fire Department Program as it diversifies the perspectives of the firefighters and brings new ideas into the organization.

Recommendation 5.9: An online learning platform such as Target Solutions would allow for more efficiency and better tracking for training purposes.

Members of the department repeatedly identified the Worcester Fire Department Training Program as a significant weakness. The addition of an online learning platform such as Target Solutions would allow for more efficiency and better tracking for training purposes.

Recommendation 5.10: Establish a formal feedback/input mechanism to receive necessary end-user feedback about the training program.

ESCI recommends that the Worcester Fire Department evaluate the use of a survey tool to collect performance feedback from firefighters about the training program. Examples of online survey tools that could be used for this purpose include SurveyMonkey, SurveyLegend, and Typeform. Gathering information directly from firefighters on an annual basis will allow department leadership to keep a focus on those aspects of the training program that firefighters indicate as being of high value. This type of feedback also enables leadership to key in on specific performance issues that may exist. The annual survey would be a good opportunity to encourage firefighters to share new ideas or other suggestions they may have about the Worcester Fire Department Training Program.

Recommendation 5.11: Regularly assess the workload of the Training Division to determine whether additional staffing is necessary to ensure that effective training is delivered on a continual basis.

Worcester Fire Department Leadership should regularly assess the workload of the Training Division to ensure that adequate staff is dedicated to the division as demands placed on the staff continue to increase.

Recommendation 5.12: Encourage all uniformed members to avail themselves of the opportunity to attend the National Fire Academy on a paid stipend once each year.

Active members of fire or emergency management organizations are eligible for a stipend reimbursement to attend the National Fire Academy in Emmitsburg, Maryland. All tuition, instruction, and course materials for National Fire Academy courses are provided at no cost. All active members of fire and emergency management organizations are eligible for stipend reimbursement once every fiscal year.

Opportunity 6: Promotional Process including Professional Development

There was a majority opinion from the members of the Worcester Fire Department that members were promoting too early with a lack of adequate experience for promotion. Three years to test for Lieutenant, one year in grade to test for Captain, and one year for District Chief were all deemed to be significantly insufficient.

Members found no fault with anyone taking the test because the system allows it. Contributors believed the times in grade needed to be expanded at each level to sit for the respective promotional exam, a career development path should be created to support those interested in promoting, and an experience period should be established before a newly promoted member could act out of grade. There were multiple mentions of members promoting into a rank and immediately acting out of grade (i.e., Captain acting as District Chief within a few shifts of being promoted to Captain). With the overall lack of professional development in the department, this practice immensely increases the overall risk of fireground operations.

Recommendation 6.1: Establish minimum criterion to determine time in grade, education, certification, competency, and professional development requirements for each position prior to allowing any individual to promote or work out of class in a temporary assignment.

This could be accomplished through internal training requirements, an assessment center, or a combination thereof.

Recommendation 6.2: Develop a Professional Development Program for all positions within the organization.

Officers who fail to learn leadership skills are challenged almost immediately upon promotion. The Worcester Fire Department stands to benefit significantly from the development and implementation of a Career Development Program.

A successful Professional Development Program will benefit both the employees and the organization they serve. The intent of the Professional Development Program is to engage employees in identifying gaps in understanding and development that prepares and enables him or her to be successful in current and future roles. This directly translates to personal fulfillment and job satisfaction as well as positioning employees for future success within the organization. A comprehensive Professional Development Program should be developed for each organizational level: frontline personnel, first-level supervisors, mid-level managers, and senior leaders.

When developing this program, the Worcester Fire Department should expand the officer candidate school to incorporate more leadership theory, strategy, tactics, and Worcester Fire Department doctrine on accountability and professionalism to better prepare members for leadership roles. This program should be heavily steeped in the introspective assessment of each officer's willingness to lead from the high moral ground.

The International Association of Fire Chiefs has developed the Officer Development Handbook, which is intended to function as the foundation for any organization's Professional Development Program. The handbook provides a foundation and explanation of the basic tenets of a Professional Development Program upon which an organization can build upon and customize to meet its own needs.

Recommendation 6.3: Train and certify all personnel who hold the position of Lieutenant to the level of Fire Officer I.

NFPA 1021 is the Standard for Fire Officer Professional Qualifications. This standard identifies the minimum job performance requirements (JPRs) for the various ranks of fire officers. NFPA 1021 defines a Fire Officer I as a fire officer, at the supervisory level, who has met the requirements established in Sections 4.2–4.7 of the standard.

Recommendation 6.4: Train and certify all personnel who hold the position of Captain to the level of Fire Officer II.

NFPA 1021 is the Standard for Fire Officer Professional Qualifications. This standard identifies the minimum job performance requirements (JPRs) for the various ranks of fire officers. NFPA 1021 defines a Fire Officer II as a fire officer, at the supervisory/managerial level, who has met the requirements established in Sections 5.2–5.7 of the standard.

Recommendation 6.5: Require completion of the National Fire Academy's Managing Officer Program for all personnel holding the position of District Chief within the department.

The National Fire Academy's Managing Officer Program is a multi-year curriculum that introduces emerging emergency services leaders to personal and professional skills in change management, risk reduction, and adaptive leadership.⁵⁶

⁵⁶ https://www.usfa.fema.gov/training/nfa/programs/mo_program.html

Recommendation 6.6: Require completion of the National Fire Academy's Executive Officer Program for those holding the position of Deputy Chief and Chief within the department.

The Executive Fire Officer (EFO) Program is the flagship program of the National Fire Academy. It provides senior fire officers with a broad perspective on various facets of fire and emergency medical services administration. The courses and accompanying research examine how to exercise leadership when dealing with difficult or unique problems within communities.⁵⁷

Opportunity 7: Recruitment, Application, and Hiring Process

The firefighter recruitment, application, and hiring process should be revised. Adding additional requirements can bolster candidate selection and better match the needs of the Worcester Fire Department.

Recommendation 7.1: Customize the Civil Service process to better assess an applicant's candidacy for the specific position of Worcester Firefighter instead of using the current generic process.

The Worcester Fire Department should customize the Civil Service process to better assess an applicant's candidacy for the specific position of Worcester Firefighter instead of using the current generic process. This would be particularly beneficial at the District Chief level as a lack of scene accountability and management were found by NIOSH to be major contributing factors to line of duty deaths. Customized assessment centers would provide the fire department a greater ability to ensure that candidates possess a minimum skillset and abilities commensurate with the position prior to promotion. Training and educational requirements needed to successfully complete an assessment center tailored to the District Chief position would dramatically improve the likelihood of improved scene accountability, management, and adherence to the chain of command.

⁵⁷

[https://www.usfa.fema.gov/training/nfa/programs/efop.html#:~:text=The%20Executive%20Fire%20Officer%20\(EFO,medical%20services%20\(EMS\)%20administration.](https://www.usfa.fema.gov/training/nfa/programs/efop.html#:~:text=The%20Executive%20Fire%20Officer%20(EFO,medical%20services%20(EMS)%20administration.)

Recommendation 7.2: The functions associated with the new firefighter hiring process should be reassigned from the Training Division to the City of Worcester Human Resources Department.

In addition to being understaffed at a time where the Worcester Fire Department has a critical need for more training, Worcester's firefighters are not Human Resources Professionals. ESCI's interviews with members of the Training Division revealed that many of the firefighters received no formal training or guidance in this area at all and often times called the person who held the position before them and asked them how they did it. Both members of the Training Division and former members of the Training Division reported that this created very inconsistent practices as people rotated in and out of the Training Division and these functions were reassigned to new people. The city would be better served to assign the functions associated with new firefighter training to the professionals in the City of Worcester Human Resources Department, thus allowing members of the Training Division to focus their efforts on firefighter training.

Recommendation 7.3: The Worcester Fire Department should consider modifying its hiring processes to allow for lateral transfers of Massachusetts Certified Firefighters.

As these firefighters are already certified, they can attend a shortened Recruit Program to learn Worcester-specific policies and procedures and then be assigned to the line more quickly than a recruit who requires the entire firefighter training program. An added benefit of hiring lateral transfers is the infusion of firefighters with experience from outside the Worcester Fire Department, which can help to diversify the think-tank within the Worcester Fire Department.

Opportunity 8: Operational Staffing

ESCI recommends that all engines and ladder trucks be staffed by a minimum of four personnel consisting of at least one officer and with no more than one out-of-class assignment per company.

The Worcester Fire Department should take steps to determine the cause of and reduce the practice of "shipping out" to different fire stations across the city where firefighters are required to mitigate emergencies while working with crews, apparatus, and equipment with which they are less familiar than those to which they are regularly assigned. When all personnel are on duty for their regularly scheduled shift, there is no need to ship firefighters out to other stations; however, various elements and conditions have led to this practice being regularly required. By identifying the root causes for this issue, the practice of shipping out can be greatly reduced. At a minimum, the Worcester Fire Department should strive to maintain 75% crew integrity for crews of four personnel.

Recommendation 8.1: All engines and ladder trucks should be staffed with a minimum of four personnel.

The value of four-person staffing cannot be overstated. The city and department should make a commitment to adopting a minimum staffing policy using NFPA 1710 that guarantees at least four qualified members on each piece of apparatus for field operations.

Recommendation 8.2: All engine and ladder companies should consist of at least one officer and with no more than one out-of-class assignment per company.

NFPA 1710 5.2.2.2.2. requires that "Each company shall be led by an officer who shall be considered a part of the company." ESCI recommends that if an officer is absent from work, they should be replaced by someone with equal or greater rank or by personnel who have met internal departmental training, certification, and competency requirements so long as no more than one out-of-class assignment occurs per company. Out-of-class assessments cannot exceed more than one class above the employee's current position.

Recommendation 8.3: Take steps to determine the cause of and reduce the practice of "shipping out" to different fire stations.

Firefighters are presently required to "ship out" to work shifts at fire stations across the city. When this happens, they are required to mitigate emergencies while working with crews, apparatus, and equipment with which they are less familiar than those to which they are regularly assigned. At a minimum, the Worcester Fire Department should strive to maintain 75% crew integrity for crews of four personnel.

Recommendation 8.4: The Worcester Fire Department should make the position of Driver a promoted position.

Each firefighter within the Worcester Fire Department is expected to be able to operate the fire apparatus. In 2017 alone, more than 15,000 fire department vehicles were involved in collisions nationwide, resulting in 4,555 firefighter injuries occurring while responding to or returning from an incident.⁵⁸ Considering the risk involved in operating emergency vehicles, it would be prudent for the Worcester Fire Department to establish promoted Driver positions that require additional and ongoing safe driver training.

If the city opts not to create a new position of promoted Driver, another option could be to assign Lieutenants to perform driver operator functions and assign a Captain as the company officer to each engine and ladder company.

Recommendation 8.5: Review and update the current Time-Off Policy.

The current time-off policy limits the amount of time that firefighters can take off during certain times of the year. It also requires that time-off requests be submitted with a long lead time. The combination of these two requirements results in firefighters not using their time off during the year and having to use it or lose it during the month of December. ESCI suggests that the current practices can be revised to better distribute time off throughout the year and to make it easier for firefighters to use their earned time off.

⁵⁸ NFPA Journal, U.S. Firefighter Injuries 2017, Nov–Dec 2018.

Recommendation 8.6: Review the mental health and substance abuse programs to ensure that firefighters have the resources they need when they need them.

Our nation's firefighters are faced with emotional needs that are very different and unique to the occupation. The percentage of firefighters struggling with career-related stress is very high, with suicide rates climbing each year. These issues manifest themselves through higher divorce rates and addictions such as alcohol, drugs, or gambling. Frequently seen in recent studies and another major concern is Post Traumatic Stress Disorder (PTSD). As these symptoms occur, employees need a support system in place that is readily accessible from someone who is qualified and truly understands his or her circumstances.

While the department has provided mental health and substance abuse programs for its firefighters, ESCI received reports of varying levels of success with the current program. A collaborative review by labor and management of the current programs and other available options would position the department to ensure that the offered programs best serve the needs of the Worcester firefighters.

Recommendation 8.7: Establish a comprehensive occupational medical program that includes medical evaluations for candidates and members.

The Worcester Fire Department should establish a comprehensive medical program that includes medical evaluations for candidates and members. NFPA 1582: *Standard on Comprehensive Occupational Medical Program for Fire Departments* provides guidance on such programs. While new firefighters receive an extensive medical physical and review, currently there are no requirements for subsequent medical and physical evaluations. The industry best practice for medical and physical examinations is to provide annual physicals.

Recommendation 8.8: Make it a priority to alert only the fire station(s) dispatched to calls to reduce the volume of radio traffic that is currently transmitted to all of the stations.

One issue that was repeatedly brought up to ESCI during the site visit meetings was a strong desire by the membership to have quiet stations. The Worcester Fire Department responded to 32,250 calls in 2019, or an average of 88 calls per day. At the time of ESCI's site visit, firefighters in every station heard the radio traffic for every call, whether or not the members of that station were assigned to respond.

A study published in the *American Journal of Industrial Medicine* in 2018 found higher rates of hypertension and high cholesterol in people who were regularly exposed to loud noises at work. Loud noises were defined as four or more hours a day, several days a week, when individuals needed to raise their voice or shout to be heard by someone standing a few feet away. The researchers concluded that as many as 14% of cases of hypertension and 9% of cases of high cholesterol were potentially a result of noise exposure, possibly due to the stress of a loud working environment.

Recommendation 8.9: Assign a second full-time employee to Special Operations.

ESCI's review of the functions assigned to the District Chief of Operations revealed that the responsibilities exceed what one full time employee can be reasonably expected to fulfill during a normal work week. Given the critical nature of the equipment and operations related to Special Operations, ESCI recommends that the City of Worcester consider assigning a second position – perhaps a Lieutenant – to better distribute the Special Operations workload.

Recommendation 8.10: Establish performance objectives in accordance with NFPA 1710 Section 4.1.2.2, then routinely analyze performance data.

4.1.2.1: The fire department shall establish the following performance objectives for the first-due response zones that are identified by the AHJ:

- *Alarm handling time completion in accordance with 4.1.2.3*
- *80 seconds turnout time for fire and special operations response and 60 seconds turnout time for EMS response*
- **240 seconds or less travel time for the arrival of the first engine company at a fire suppression incident*
- *360 seconds or less travel time for the arrival of the second company with minimum staffing of 4 personnel at a fire suppression incident*
- *For other than a high-rise, 480 seconds or less travel time for the deployment of an initial full alarm assignment at a fire suppression incident*
- *For high-rise, 610 seconds or less travel time for the deployment of an initial full alarm assignment at a fire suppression incident*
- *240 seconds or less travel time for the arrival of a unit with first responder with automatic external defibrillator (AED) or higher-level capability at an emergency medical incident*
- *480 seconds or less travel time for the arrival of an advanced life support (ALS) unit at an emergency medical incident, where this service is provided by the fire department provided a first responder with an AED or basic life support (BLS) unit arrived in 240 seconds or less travel time*

Overview of Compliance Methodology

For this analysis to prove beneficial to the community, the department, and the city's policymakers, the Worcester Fire Department should continually and routinely analyze performance data.

Compliance is best achieved through a systematic approach. ESCI suggests the following six-step compliance model.

Figure 147. Six-Step Compliance Model

Phases of the Compliance Model

Phase 1—Establish/Review Performance Measures

Conduct a full review of the performance measures at least every five years:

- Identify services provided.
- Define levels of service.
- Categorize levels of risk.
- Develop performance objectives and measures.

Phase 2—Evaluate Performance

Performance measures are applied to actual service provided:

- System level.
- First-Due Area level.
- Unit level.
- Full Effective Response Force (ERF).

Phase 3—Develop Compliance Strategies

Determine issues and opportunities:

- Determine what needs to be done to close the gaps.
- Determine if resources can/should be reallocated.
- Seek alternative methods to provide service at desired level.
- Develop budget estimates as necessary.
- Seek additional funding commitment as necessary.

Phase 4—Communicate Expectations to Organizations

Communicate expectations:

- Explain method of measuring compliance to personnel who are expected to perform services.
- Provide feedback mechanisms.
- Define consequences of noncompliance.

Train personnel:

- Provide appropriate levels of training/direction for all affected personnel.
- Communicate consequences of noncompliance.
- Modify (remediate) business processes, business application systems, and technical infrastructure as necessary to comply.

Phase 5—Validate Compliance

Develop and deploy verification tools and/or techniques that can be used by sub-sections of the organization on an ongoing basis to verify that they are meeting the requirements:

- Monthly evaluation.
 - Performance by unit.
 - Overall performance.
 - Review of performance by division/section management.
- Quarterly evaluation.
 - Performance by unit.
 - Performance by first-due.
 - Overall performance.
 - Review of performance by executive management.

Phase 6—Make Adjustments/Repeat Process

Review changes to ensure that service levels have been maintained or improved. Develop and implement a review program to ensure ongoing compliance:

- Annual review and evaluation.
 - Performance by unit.
 - Performance by first-due.
 - Overall performance.
- Review of performance by governing body.
- Adjustment of performance standards by governing body, as necessary.
- Adoption of performance measures by Governing Body.
- Establish management processes to deal with future changes in the service area.

Recommendation 8.11: The Worcester Fire Department should provide an annual report to the AHJ in accordance with NFPA 1710 4.1.2.5.1.

4.1.2.5.1 The fire department shall evaluate its level of service and deployment delivery of alarm handling time, turnout time, and travel time performance objectives on an annual basis.

4.1.2.5.2 The evaluations shall be based on emergency incident data relating to the level of service, deployment, and the achievement of each travel time performance objectives in each geographic area within the jurisdiction of the fire department.*

4.1.2.6 The fire department shall provide the AHJ with a written annual report.

4.1.2.6.1 The annual report shall define the geographic areas and/or circumstances in which the requirements of this standard are not being met.

4.1.2.6.2 The annual report shall explain the predictable consequences of these deficiencies and address the steps that are necessary to achieve compliance.

4.1.2.6.3 The annual report shall identify any deficiencies that are anticipated to develop in the next 3 years and address the steps necessary to continue to achieve compliance to this standard.

ESCI suggests that the Worcester Fire Department should include a concise report to the AHJ that includes only the aforementioned information. This document should serve as an ongoing source of evaluation and discussion between the Worcester Fire Department and City Officials about the resources that are required to meet the established performance criteria.

Opportunity 9: Support Services Staffing

All of the Support Services Divisions—Training, Fire Prevention, and Maintenance—are understaffed and will require additional personnel in order to satisfy their core missions. Additionally, department management must have the ability to select and retain qualified personnel in these divisions to ensure continuity of operations and allow for succession planning.

Recommendation 9.1: Develop an incentive program that makes it more desirable for members to come off shift work and accept a position with Monday–Friday hours.

The Worcester Fire Department struggles to fill positions that require Monday through Friday hours. The fire department should investigate ways to incentivize members to work in these positions to assure that the support services roles are filled with quality candidates.

Recommendation 9.2: Increase the number of Life Safety Educators on staff.

Currently, one Lieutenant and one Firefighter are assigned to the Public Education Unit. The Worcester Fire Department's Public Education Unit has developed a very robust Community Risk Reduction Program. This program has been recognized on a national level, including presentations made at the Vision 20/20 Conference. Specific programs currently target school age children as well as college students and high-risk populations.

The Public Education Unit reported reaching between 20–28% of school-aged children with a focus on Pre-Kindergarten through 3rd grade, with 3rd graders being evaluated to validate the retention of what they have been taught. The Worcester Fire Department should develop a staffing plan that can support educating all of the city's school-aged children.

Recommendation 9.3: Increase the number of Fire Inspectors to bring inspection frequency into compliance with NFPA 1730.

The present staffing level does not allow regular inspections to be completed at all target hazard occupancies such as apartment complexes and multi-family dwellings. These occupancies are often only inspected when a complaint is generated by a tenant, landlord, or the building official.

NFPA 1730: *Standard on Organization and Deployment of Fire Prevention Inspection and Code Enforcement, Plan Review, Investigation, and Public Education Operations*, 2019 Edition, specifies:

6.6 Required Personnel. The AHJ shall determine the minimum resources, personnel, and equipment levels necessary to perform code enforcement and inspection activities.*

6.7 Minimum Inspection Frequency. Existing occupancy fire prevention inspection and code enforcement inspection frequencies shall not be less than those specified in Table 6.7.

Figure 148. Table 6.7 Minimum Inspection Frequency

Occupancy Risk Classification	Frequency
High	Annually
Moderate	Biennially
Low	Triennially
Critical Infrastructure	Per AHJ

Recommendation 9.4: Increase the number of Fire Investigators to comply with NFPA 1730.

The Worcester Fire Department should increase the number of fire investigators to comply with NFPA 1730: *Standard on Organization and Deployment of Fire Prevention Inspection and Code Enforcement, Plan Review, Investigation, and Public Education Operations*. The 2019 Edition, specifies:

8.6.1 The resources and personnel required to provide the level of service required by this chapter shall be determined by the AHJ in accordance with this standard.*

8.6.1.1 The FPO shall have a standard operating guideline (SOG) for the staffing levels of fire scene examination.

8.6.1.2 The time necessary to conduct investigation activities under this chapter shall be evaluated as follows:

- (1) On scene: Time spent on activities conducted at a fire scene*
- (2) Off scene: Time spent on activities conducted away from the fire scene*
- (3) Travel time: Total travel time related to an activity*
- (4) Court appearance: Time required to attend or testify in court*
- (5) Preparation time: Time required to prepare for testimony*
- (6) Report writing: Time spent generating reports*
- (7) Telephone / Email: Time spent on calls and emails attributed to fire investigation*
- (8) Process reports: Time spent entering, approving, formatting, distributing, copying*

- (9) Data entry: Time spent by administrative staff to enter data*
- (10) Data search: Time spent searching and retrieving data*
- (11) Filing: Time spent by administrative staff for general filing*
- (12) Human resources (HR): Time spent by administrative staff for general HR duties*
- (13) Financial: Time spent on general budget and accountings duties*
- (14) Legal/disclosure: Time spent copying or preparing disclosure*
- (15) Cost recovery: Time spent on cost recovery*

Recommendation 9.5: Regularly review city demographic information for “at risk” populations and realign targeted Community Risk Reduction Programs as population changes occur.

Often defined very broadly, the term “populations at risk” does not include all citizens within a defined group, as they experience risk at varying levels or rates. Coupling two or more risk factors contributes to significantly higher levels of risk than those who only experience one risk category. Those with compounded risk factors should be a priority in prevention programs and strategies.

Broadly, “populations at risk” includes citizens at the lower end of socioeconomic status, those with housing and transportation challenges, those of minority status or with English-speaking challenges, and households containing citizens with disabilities, over 65 and under 17 years of age. More specifically, citizens most at risk include the impoverished, disabled, homeless, racial, and ethnic minorities, as well as people with low literacy. Also, groups suffering from poor health or who are uninsured/underinsured may be at greater risk during emergency or disaster situations.

Fires in the home can be potentially dangerous and deadly for everyone, but persons with disabilities and impairments face additional challenges. Persons with disabilities often have a difficult time identifying or escaping a fire. There are 20,356 households that have identified as having one member with a disability.⁵⁹ These citizens in the community would benefit from programs to assist in their needs during times of emergency and for emergency planning efforts.

In Worcester, 34.6% of the population purport to speak a primary language other than English. Often, organizations overcome language barriers through a diversified workforce, allowing these persons to receive proper care during emergency incidents. This suggests that normal English versions of fire safety messages are potentially missing a large cross-section of the community. Prevention and education messages could reach more residents if the messaging were expanded to include additional languages.

⁵⁹ *Environmental Systems Research Institute.*

Recommendation 9.6: Develop a program to provide call coverage by members of the Fire Prevention Division outside of normal business hours.

The Division is staffed Monday through Friday. Currently, there is no on-call coverage after normal business hours. Division Staff reported that the availability of staff after hours for enforcement questions and fire investigations is currently about 50% of the time. When staff is not available, complaints, code enforcement, and investigations are generally followed up on a Monday morning.

Recommendation 9.7: Conduct an evaluation of the Worcester Fire Department's information technology needs.

ESCI's interviews revealed that many aspects of the Worcester Fire Department's operations are hampered by antiquated technology. Both the Training and Prevention Divisions are using basic Excel spreadsheets when they would be better served by a new software system. Currently, there is no tracking software used for investigation reports, and the majority of origin and cause reports are stored either in paper files, CDs, or external hard drives.

Recommendation 9.8: Ensure that fire investigators do not operate alone on fire scenes.

ESCI's interviews revealed that there are often cases when fire investigators are left alone to investigate emergencies. This is unsafe.

NFPA 1730: *Standard on Organization and Deployment of Fire Prevention Inspection and Code Enforcement, Plan Review, Investigation, and Public Education Operations*, 2019 Edition, specifies:

8.6.1.1 The FPO shall have a standard operating guideline (SOG) for the staffing levels of fire scene examination.

ESCI strongly recommends that the Worcester Fire Department develop a policy that ensures that fire investigators do not operate alone on fire scenes.

Opportunity 10: Emergency Response Deployment

There exist within the Worcester Fire Department many opportunities to improve emergency response deployment. The City of Worcester is growing and changing; the fire department must adjust its operations to meet the resulting changing service demands of the city.

Consideration should be given to whether the city has the appropriate number of fire stations in the appropriate places; the design of the fire stations to facilitate efficient firefighter response, the geographical response districts and workloads of each crew, and to assuring the appropriate types and numbers of resources are being sent to the various types of calls to which the fire department responds.

For the purposes of long-term planning, Emergency Response Deployment includes planning considerations for buildings, apparatus, and equipment.

Recommendation 10.1: Modify the initial response sent to structure fires to satisfy critical staffing needs based on risk and hazard.

The Worcester Fire Department should use the updated Community Risk Assessment to prepare standard response protocols inherent to the community. The protocols should delineate the number and type of crews and the total number of firefighters to be deployed for each response based on the risk event to which they are responding.

Currently, the department responds with the same type and number of resources to all reported fires within the city. However, certain locations, building types, and hazards will require a greater commitment of resources. Worcester Fire Department should evaluate each of these areas individually and ensure that an appropriate number of equipment and personnel are activated on the initial notification by dispatch for the given risk or hazard.

Recommendation 10.2: Evaluate aerial apparatus to determine which type(s) are best suited for the various response areas in the city.

The Worcester Fire Department should conduct a truck company study to determine the best type(s) (i.e., combination of tillers and towers or tillers and rear mounts, etc.) of apparatus for the city and begin moving to standardization.

Recommendation 10.3: Plan for significant fire station maintenance and renovations in the coming years.

The Worcester Fire Department infrastructure will require significant financial investments in the coming years. Eight of the ten fire stations are more than 30-years-old. The remaining two fire stations are 13 and 20 years old and require scheduled maintenance and repairs before they fall into the same state of disrepair as the rest of the stations.

ESCI found the living conditions within all except for the three newest Worcester Fire Stations to be in poor to extremely poor condition. In many cases, firefighters have brought in their own furniture and worked with their crews to perform minor renovations as approved by the fire department to make the stations habitable.

Renovations and new buildings should include consideration for automatic sprinkler protection, drive-through bays, cancer prevention engineering, and security.

Recommendation 10.4: Identify locations for future new or relocated fire stations.

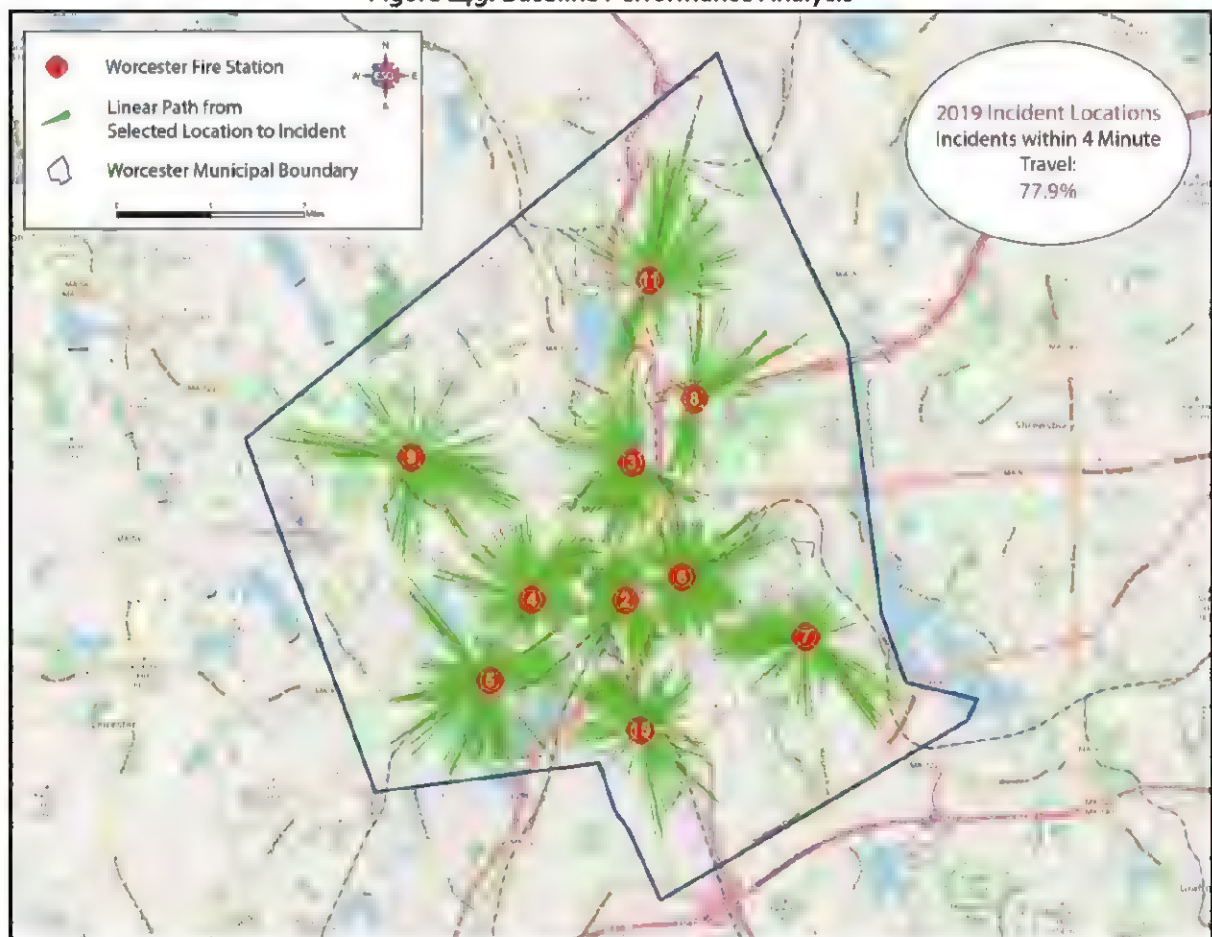
The location and placement of fire stations are major components of how staffing and deployment strategies are developed. Particularly in a city such as Worcester, locations that were ideal 100 years ago may not be optimal locations today. Changes in roadways, bridges, tunnels, neighborhoods, and populations over time can strongly influence how effective a fire station and the crews housed there can be.

In this section, GIS software was used to model the effectiveness of Worcester's current fire station locations and create a baseline for comparison. Next, an optimization analysis was performed, and the results were compared to the baseline. Finally, an optimization of Station 2 was conducted as this facility is in critical need of rehabilitation or relocation.

Baseline Performance Model

To provide a foundation for comparison of performance, a baseline performance model of Worcester's current fire station locations was created. Using 2019 incident data and current fire station locations, a model was created which seeks to create the largest service area possible while also encompassing the greatest number of incident locations within a four-minute travel time. The four-minute travel was selected as this is the maximum travel time allotted by NFPA 1710 for urban career fire departments.

Figure 14.9. Baseline Performance Analysis

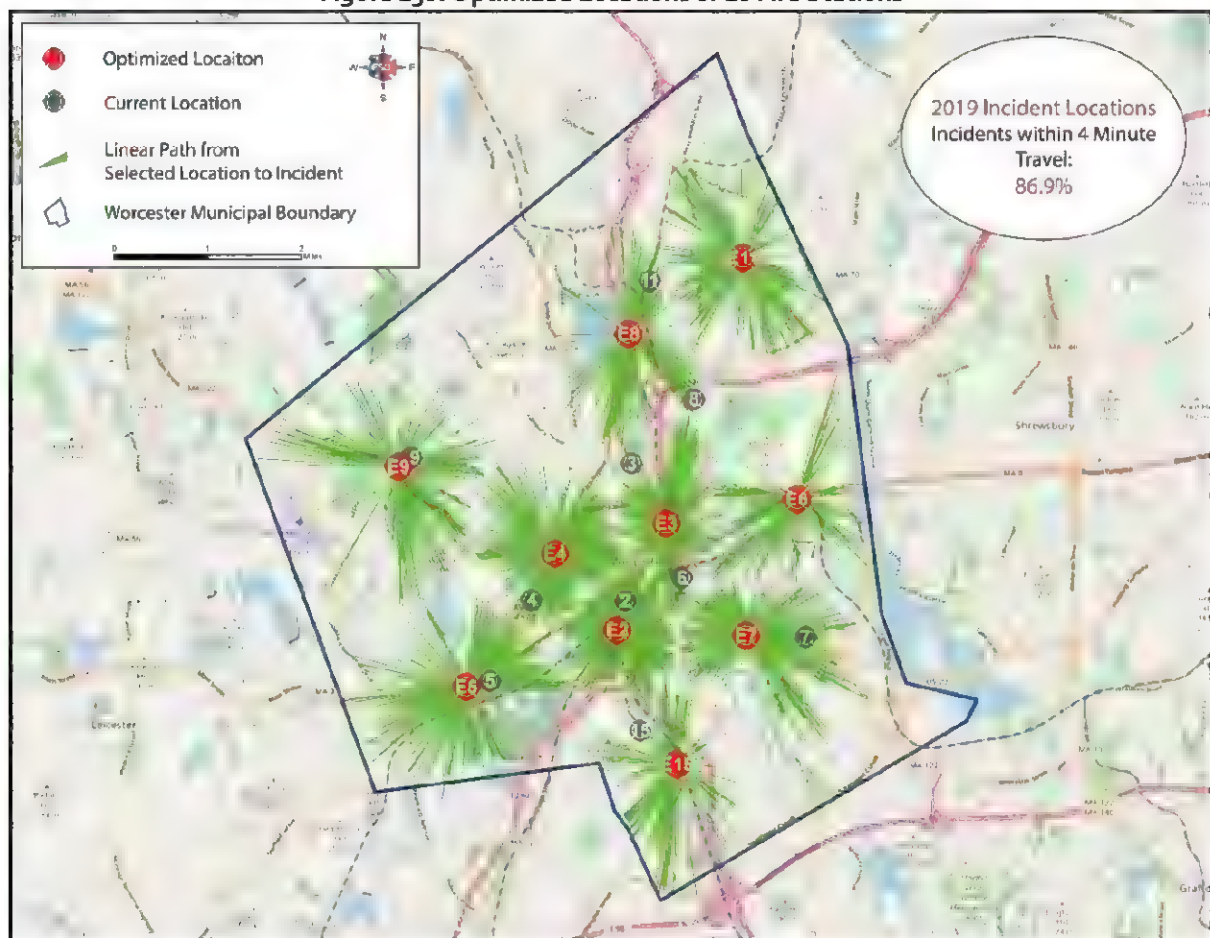


The results of the model indicated that the current deployment configuration should have the ability to reach 77.9% of the 2019 service demand within a four-minute travel time.

Optimized Performance Model

Next, a total optimization analysis was performed to determine 1) the potential impact of optimally siting 10 fire stations throughout the city, and 2) how current locations align with the overall optimized model. While it is not feasible for Worcester to relocate every fire station, this model provides an academic overview of the efficiency of the current locations compared to a theoretically optimized deployment.

Figure 150. Optimized Locations of 10 Fire Stations

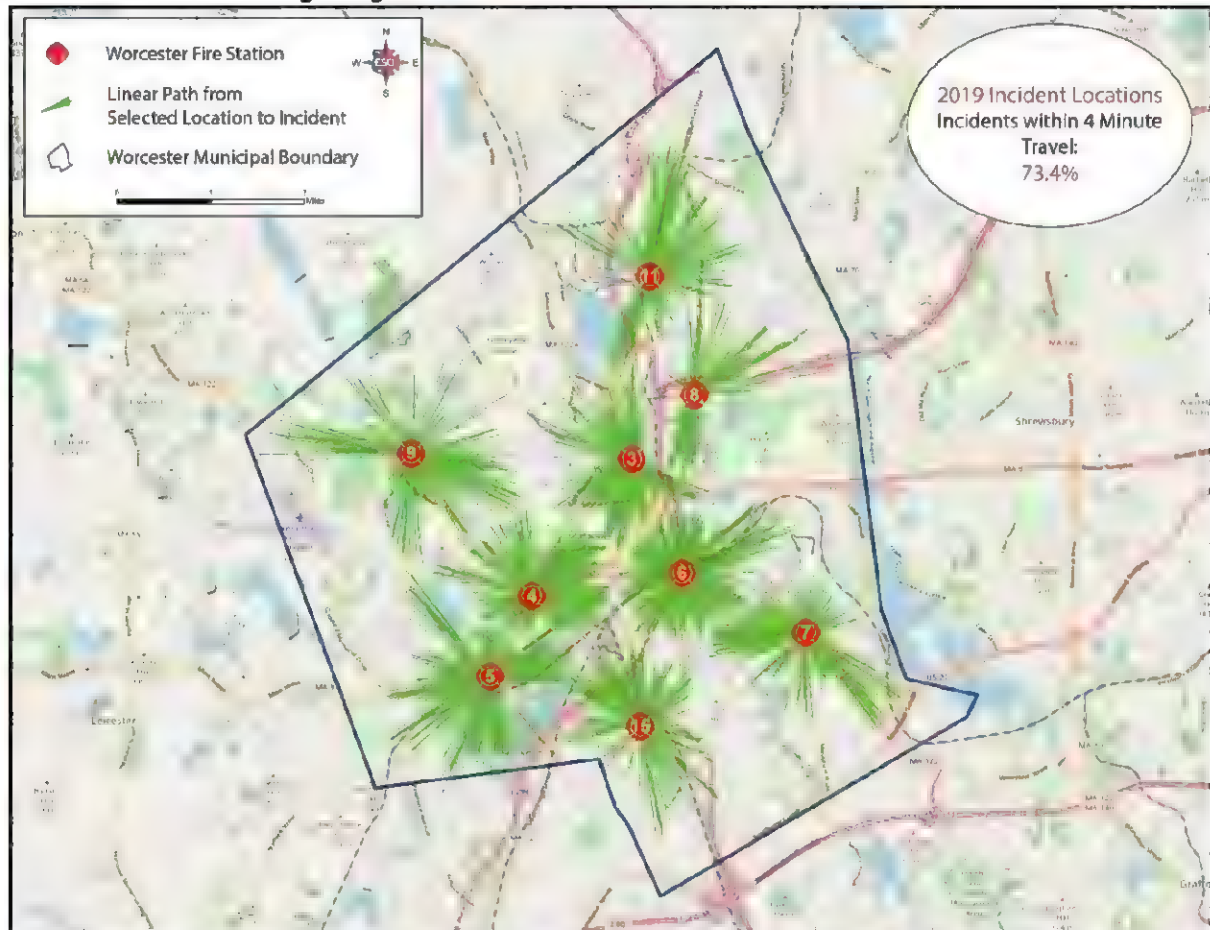


The results of this model indicate that if 10 fire stations were placed in the optimal locations, the number of incidents that could be reached within a four-minute travel time increased by 9%. Additionally, it illustrates that there is a high confidence level that Stations 5 and 9 are very near the optimal location, that Station 2 could be positioned slightly south of its current location, and that additional coverage to the eastern side of the city is needed to improve effectiveness.

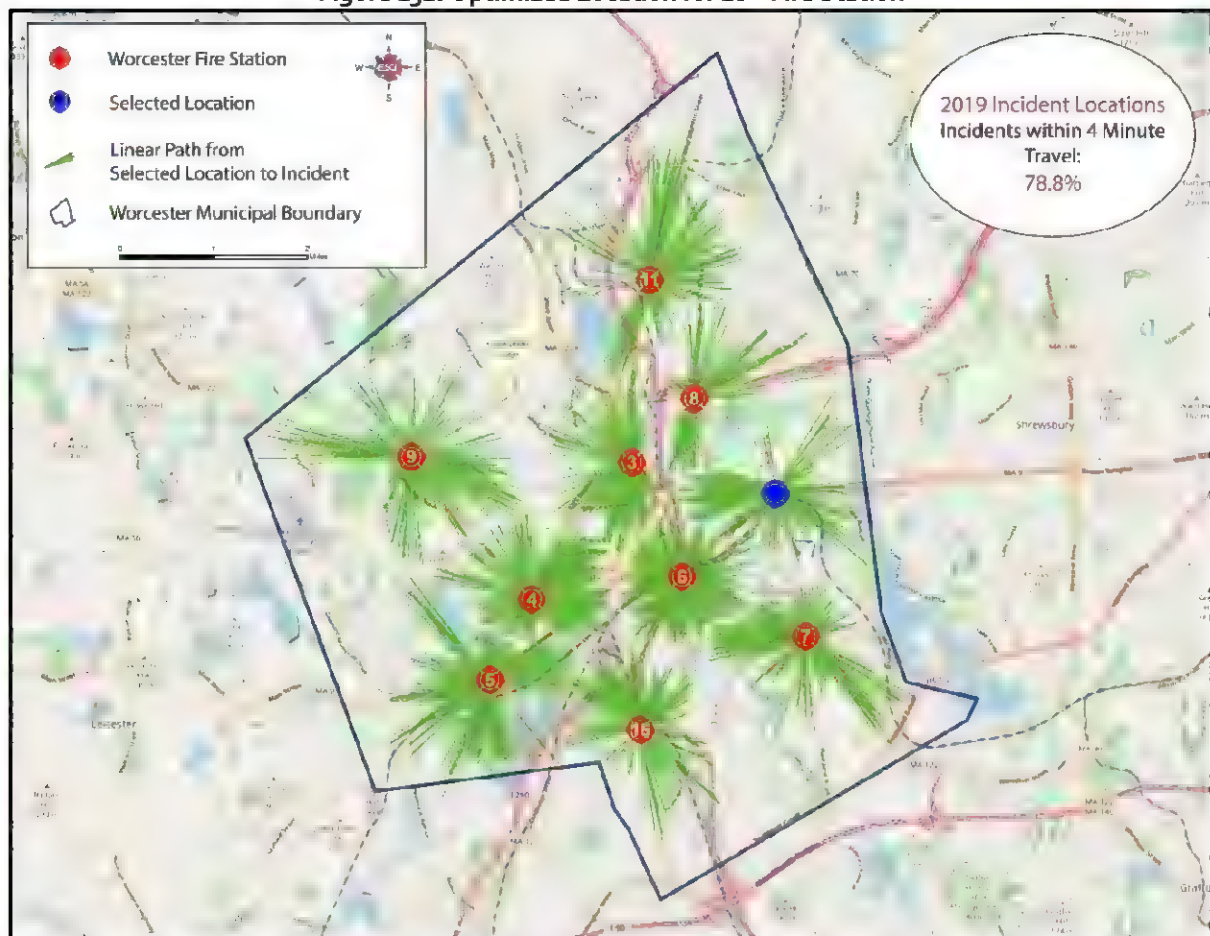
Station 2 Relocation Performance Model

The final set of analyses provides a comparison of the impact of removing Station 2 from the system, then selecting an optimized location. The first model, which removes the facility from the system, was performed as a point of comparison with the final results and does not in any way imply that the city should reduce the number of facilities. The results are shown below.

Figure 151. Baseline Performance with Station 2 Removed



When Station 2 is removed from the system, a 4.5% decrease in performance is indicated. Next, a location was selected by the model for an optimized location of this facility, given the current configuration of the system.

Figure 152. Optimized Location for 10th Fire Station

The results of this model show that a 0.9% improvement in performance could potentially be achieved if Station 2 were relocated east to approximately the intersection of Plantation Street and Belmont Street. However, the results of all modeling should be considered in their totality, and decisions should not be made based on the results of one model. Additional considerations such as land availability, zoning, cost, and whether it may be more beneficial to site this station in the location selected within the total optimization and relocate a different station to the east must be considered. A 0.9% predicted increase in performance is not a compelling reason to move Station 2 out of its current district; however, it may provide support for relocating Station 6 within its current district when the building reaches the end of its serviceable life. Any decisions on station placement, relocation, or optimization should use the most recent data available and be reevaluated prior to committing to a major capital investment. ESCI suggests that the Worcester Fire Department consider the locations of its existing firehouses as they relate to where the current demands for service are within the city when deciding which fire stations to renovate and which to relocate.

Conclusion

The ESCI project team began collecting information about the Worcester Fire Department in March 2020. The team members recognize that this report contains a large amount of information. ESCI would like to thank the Worcester Fire Department and City of Worcester officials for their efforts in bringing this project to fruition.

It is ESCI's sincere hope the information contained in this report is used to its fullest extent, and that the emergency services that the Worcester Fire Department provides to the citizens and the surrounding area will be improved by its implementation.

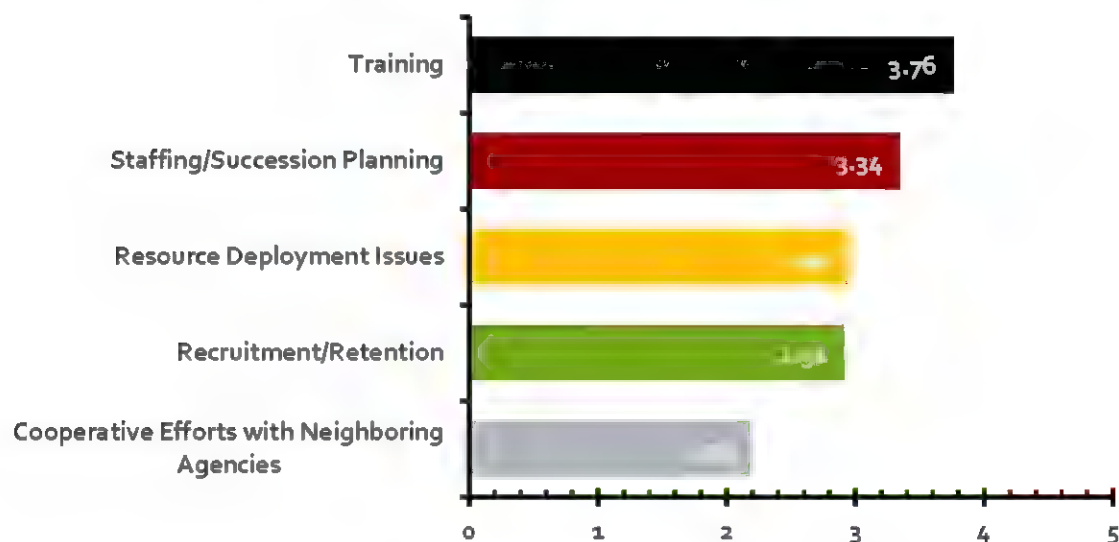
Appendix A: Survey of Worcester Residents

A summary of the most common comments has been listed for each question. The City of Worcester has been provided with a complete copy of all responses.

- 1. Please rank the following according to importance to you, with "1" most important and "5" least important:**

Answered	240
Skipped	3

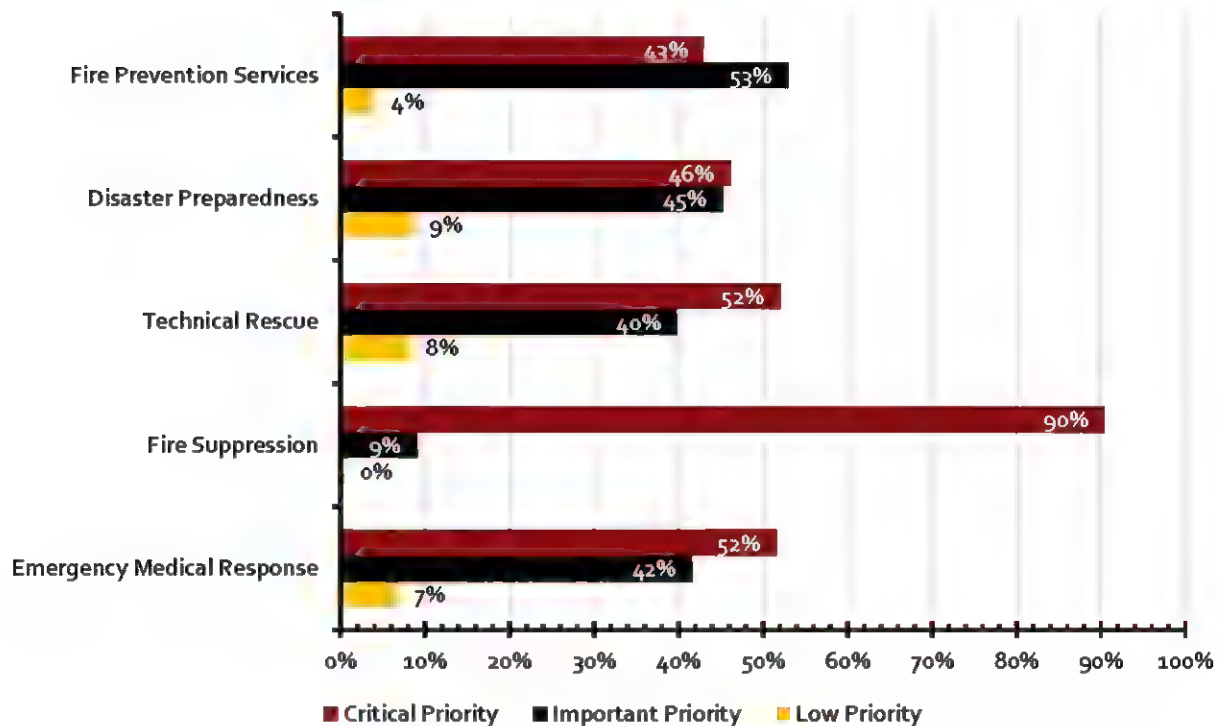
Figure 153. Question 1 Response Results



2. Please rank the following services provided by the Worcester Fire Department using a scale of critical priority, important priority, or low priority. If you would like to see a service added, please list it in the comments field.

Answered 221
Skipped 22

Figure 154. Question 2 Response Results



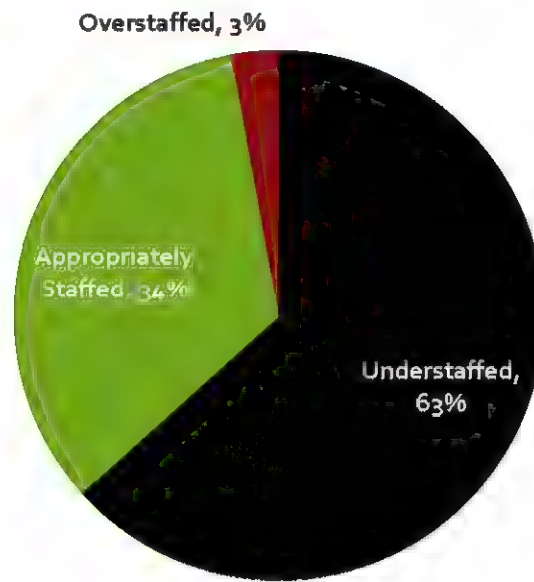
Sampling of the Most Common Responses

- All firefighters need to be trained to the minimum level of EMT in order to increase efficiency and to be able to provide Basic Life Support while waiting for Worcester EMS. Requiring firefighters to be trained only to the level of EMR does not cut it anymore. COVID-19 has taught us that we must be prepared as much as possible.
- More staffing.
- Our triple deckers are fire traps. We've known this for years. It needs to be addressed on a macro-level.

3. Please select the option that reflects your opinions as they relate to staffing. Please add any explanatory comments in the notes section immediately following the question.

Answered	210
Skipped	33

Figure 155. Question 3 Response Results

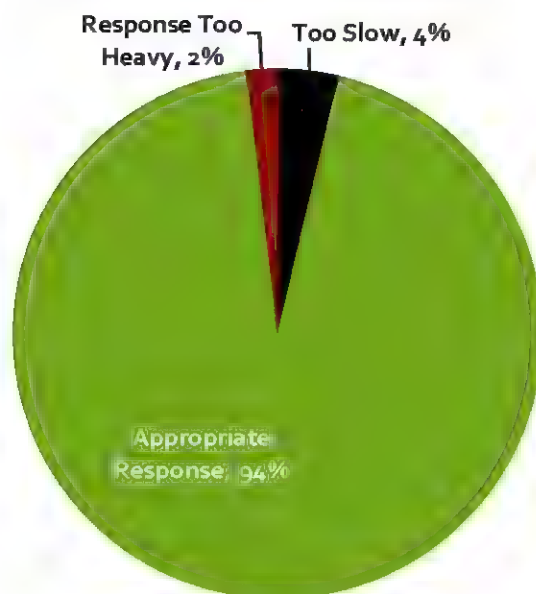


Sampling of the Most Common Responses

- Understaffed and overworked. Uneven distribution of calls amongst companies, likely due to existing station locations and geographical constraints. Would like to see more fire companies and opening new stations.
- Fire Prevention is understaffed for a city this size.
- Not enough diversity in the ranks and leadership. Considering the number of calls the Worcester Fire Department and WPD make to non-English speaking homes, it is imperative that both departments recruit and promote more Spanish speakers.

4. Please select the option that reflects your opinions as they relate to response performance. Please add any explanatory comments in the notes section immediately following the question.

Figure 156. Question 4 Response Results



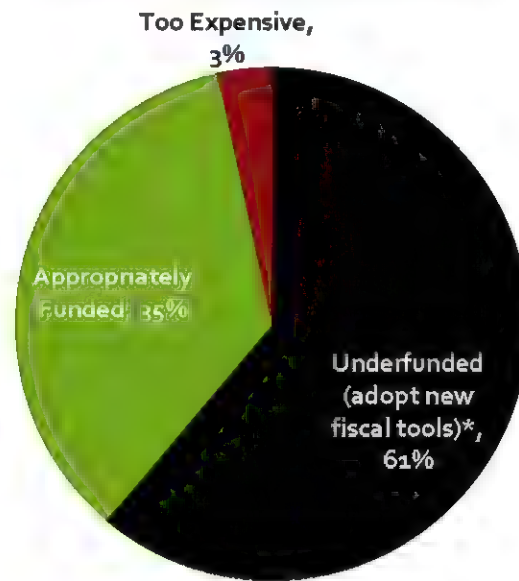
Sampling of the Most Common Responses

- Great and professional response.
- Man/Women staffing levels need to increase dramatically.
- Response times are appropriate more staffing makes that response even better.

5. Please select the option that reflects your opinions as they relate to the cost of services. Please add any explanatory comments in the notes section immediately following the question.

Answered	206
Skipped	37

Figure 157. Question 5 Response Results



Sampling of the Most Common Responses

- Ensure the Fire Dept has the appropriate funding for training, recruitment, and equipment/supplies.
- Fire Prevention is very underfunded. No incentive to work there, should be a pay grade higher to attract qualified staff. Dive overtime is a waste of money. No need to have any diver on shift at any time, never mind hiring overtime just to have 2 on duty that have a 99% chance of not having a dive call. Safety overtime is a waste, The addition of safety Captains have done nothing to make a fireground safer. Firefighters are still killed; few safety staff care about their job; most do not step up.
- Why is the FD budget \$10 million less than WPD?

6. Please list, in priority order, the expectations you have of your fire department:

Sampling of the Most Common Responses

- Respond to fires/ emergency situations, educate the public on fire prevention and fire safety.
- Keep up the great work! Undervalued.
- Need better training and tools to prevent loss of life of firefighters and the public.

7. Please list any concerns you have regarding your fire department:

Sampling of the Most Common Responses

- Safety of firefighters 2) condition of fd facilities 3) condition of fd equipment.
- Staffing.
- The recent deaths of firefighters over the past few years.

8. Please list any strengths you would like to share regarding your fire department:

Sampling of the Most Common Responses

- Always there for us!
- Very courteous.
- Most dedicated and professional people I know.

9. Thank you for providing your valuable time and perspective in this Strategic Planning process. Your ratings, observations, and comments will be compiled and used to guide the process from this point forward. If you have any further comments, please add them below. If you would like to discuss your comments privately after this session, please include your contact information in the comment box. Comments will not be linked to individuals but will be compiled with the collective group feedback and used to help guide the process.

Sampling of the Most Common Responses

- God bless our WFD.
- I think the dept needs to get back to having deputy chiefs on every shift like once before.
- The department honestly needs a hand grenade to blow itself up and start over. Huge systematic and structural changes are needed. The current fire administration is not capable of this task.

Appendix B: Survey of Worcester Businesses

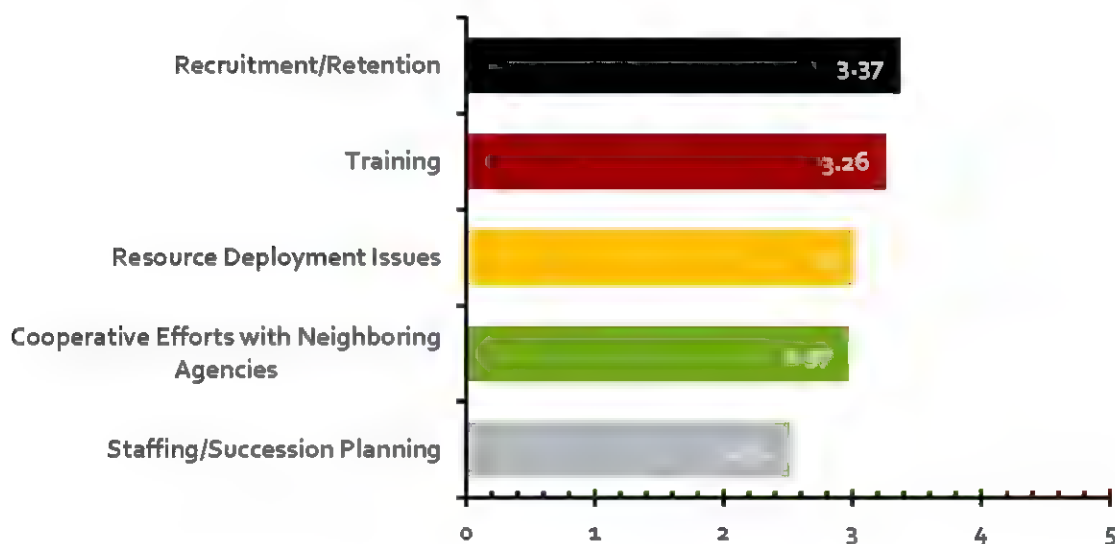
A summary of the most common comments has been listed for each question. The City of Worcester has been provided with a complete copy of all responses.

1. Please rank the following according to importance to you, with "1" most important and "5" least important:

Answered 42

Skipped 1

Figure 158. Question 1 Response Results

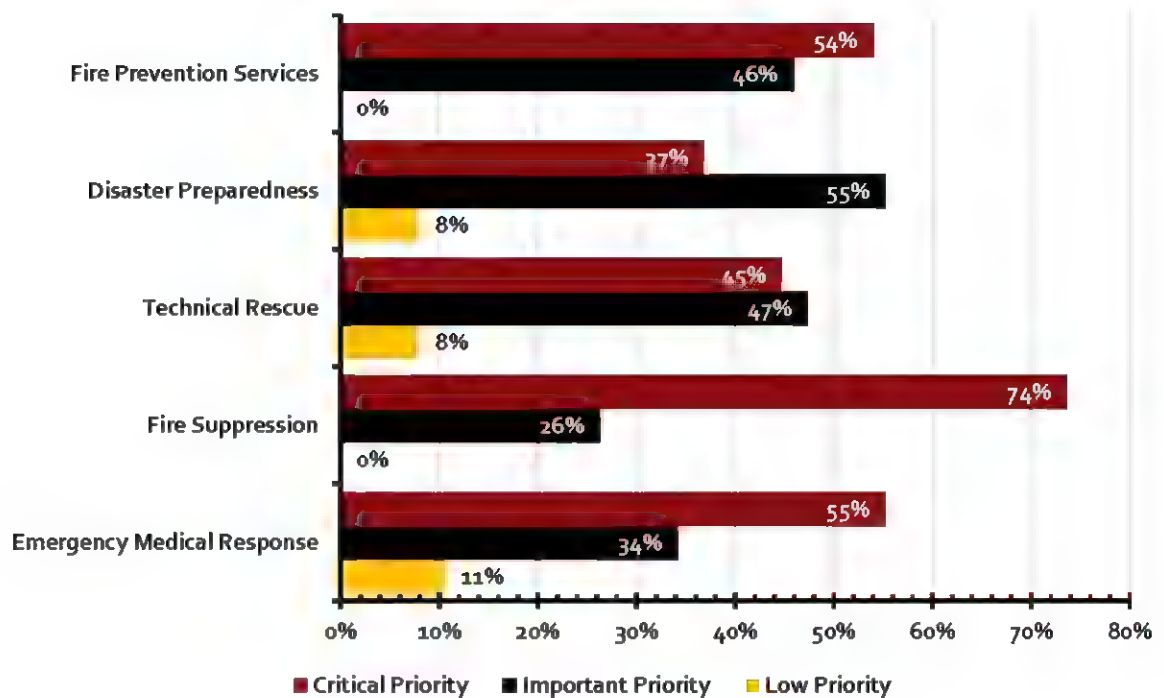


2. Please rank the following services provided by the Worcester Fire Department using a scale of critical priority, important priority, or low priority. If you would like to see a service added, please list it in the comments field.

Answered 38

Skipped 5

Figure 159. Question 2 Response Results



Sampling of the Most Common Responses

- Community education and awareness outreach.
- Education or certificates for landlords to protect them from tenants who tamper with smoke detectors.
- Fire Prevention classes in schools; and the community where you would give classes in other languages in economically poor neighborhoods where poor people live; especially about using grills and indoor heaters etc....Also, letting the immigrant community know that you are NOT the police and are there to explain about them being safe.

3. Please select the option that reflects your opinions as they relate to staffing. Please add any explanatory comments in the notes section immediately following the question.

Answered	33
Skipped	10

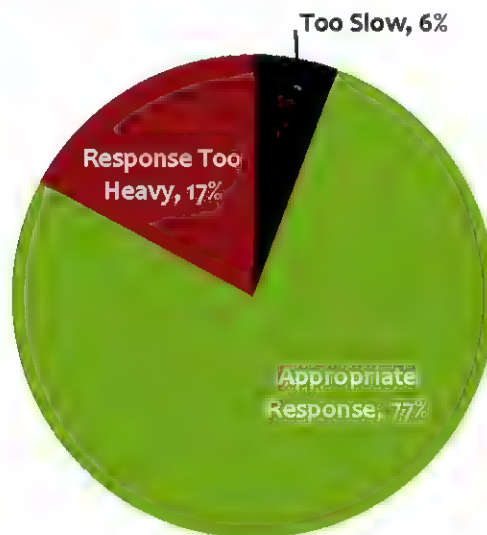
Sampling of the Most Common Responses

- A sufficient number of people have to be available when they are needed.

4. Please select the option that reflects your opinions as they relate to response performance. Please add any explanatory comments in the notes section immediately following the question.

Answered	35
Skipped	8

Figure 160. Question 4 Response Results



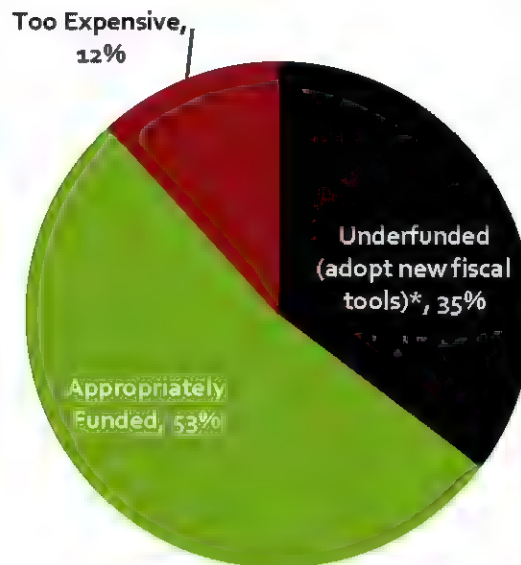
Sampling of the Most Common Responses

- In some cases slow due to distances from fire stations. There should be small fire stations (one fire truck?) in areas far from areas' headquarters.
- Everybody has a cell phone people can send you a video when they call on these complaints as to what is going on exactly, we don't need to send fire trucks to every minor car accident every minor incident.
- Too many trucks and fireman on site along w/ Police and Paramedics. Just don't need that many when over half the responders are standing around it's just not necessary.

5. Please select the option that reflects your opinions as they relate to the cost of services. Please add any explanatory comments in the notes section immediately following the question.

Answered 34
Skipped 9

Figure 161. Question 5 Response Results



Sampling of the Most Common Responses

- I'm not sure what needs the Worcester Fire Department has?
- Think Privatizing Services): Hospitals, big multi housing complex, and similar like businesses Plazas should have their own fire stations (small) with paid staff. Will be supported by City Fire Dept. in needed fire cases. This will reduce City cost.
- You have to tell us if you need more funds to do your jobs efficiently and safely....please do.

6. Please list, in priority order, the expectations you have of your fire department:

Sampling of the Most Common Responses

- Prompt response, well trained in emergency services, respectful attitude toward all
- Quick response to put out fires.
- Respond to fires and other lifesaving emergency. Provide fire safety education to schools and community.
- agencies. Respond to Fires. Save Lives.
- Saving people from fire, saving peoples' homes & businesses.

7. Please list any concerns you have regarding your fire department:

Sampling of the Most Common Responses

- My concern is do the firefighters have all the equipment they need to keep them safe, the community safe? Are there protocols in place protecting the firefighters from work hazards ie cancer?
- Needs to be more business friendly.
- That the staff is not reflective of the community they serve.

8. Please list any strengths you would like to share regarding your fire department:

Sampling of the Most Common Responses

- I have never had a complaint about our department, nor have I ever had anyone complain about the department to me. 👍👍
- I think the firefighters in the city do a great job helping people and protecting people's property responding to calls in all types of weather fire department is always on the scene in very short time they've saved lives & millions of dollars in property and help us to have a safe city.
- I wholeheartedly support our fire department.

9. Thank you for providing your valuable time and perspective in this Strategic Planning process. Your ratings, observations, and comments will be compiled and used to guide the process from this point forward. If you have any further comments, please add them below. If you would like to discuss your comments privately after this session, please include your contact information in the comment box. Comments will not be linked to individuals but will be compiled with the collective group feedback and used to help guide the process.

Sampling of the Most Common Responses

- As the saying goes, when everyone is fleeing a burning building, firefighters are entering the building. These are true heroes, and they deserve all our fiscal and emotional support the city can afford. Do NOT defund our civil servants.
- I appreciate all firefighters. I want to make sure we are doing everything we can to keep them safe.

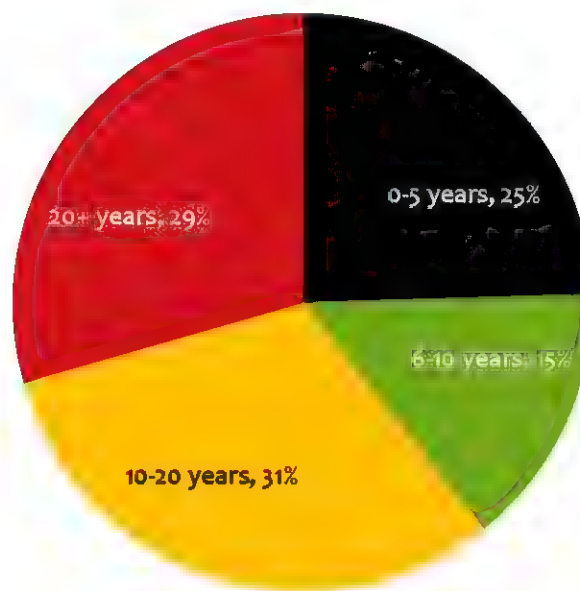
Appendix C: Survey Worcester Firefighters

A summary of the most common comments has been listed for each question. The City of Worcester has been provided with a complete copy of all responses.

1. **Please identify your total number of years working for the Worcester Fire Department:**

Answered	265
Skipped	1

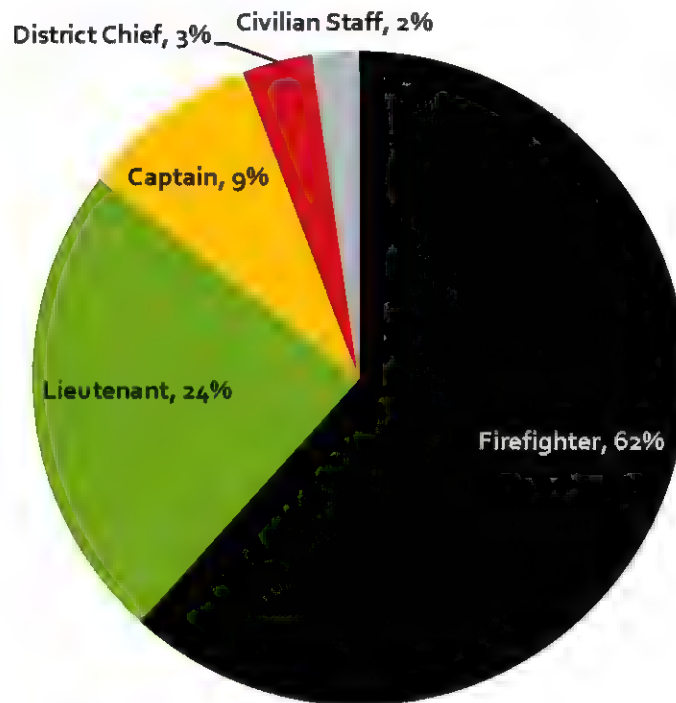
Figure 162. Question 1 Response Results



2. **Which one of the following best describes your current position?**

Answered 261
Skipped 5

Figure 163. Question 2 Response Results



3. **If you could change one thing about the Worcester Fire Department, what would it be?**

Sampling of the Most Common Responses

- The department's culture and lack of accountability.
- A longer period of time before a firefighter can take the lieutenants exam and to have a practical portion of the exam.
- An increase in manpower.
- Training division should be a division of the Worcester Fire Department not just a few people. It is nowhere large enough in terms of manpower to recruit, vet, and train academies and train the line. It's the only way we can all get on the same page.

4. **In your opinion, what is the best way to communicate information at the Worcester Fire Department?**

Sampling of the Most Common Responses

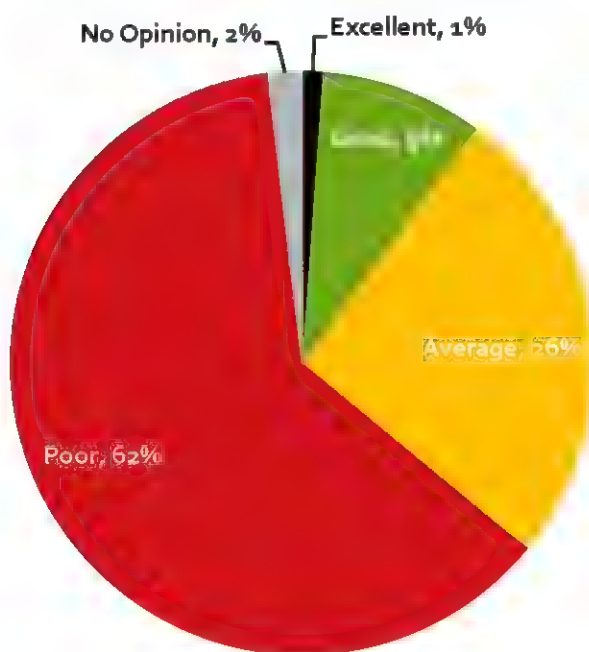
- Chain of command.
- Chiefs actually visiting stations and talking.
- From the chief it would be nice to have a weekly/monthly update whether it be video, email, or newsletter. Most other important information would be nice to have in video or in person.

5. **How would you rate morale in the Worcester Fire Department?**

Answered 264

Skipped 2

Figure 164. Question 5 Response Results



6. **What suggestions do you have for improving firefighter morale in the Worcester Fire Department?**

Sampling of the Most Common Responses

- Address suppression staffing shortages as well as those in training and prevention. Maintain the facilities, a few of the stations are in desperate need of repairs and improvements in the living environment or simply need replacement. Bring back the suppression in group deputies to alleviate the workload on the existing two deputies allowing them to focus on managing their divisions more effectively with the decrease in their span of control.
- Hold officers accountable for their actions, push for senior men to take promotional exams more, discourage younger inexperienced members to not take it until they learn their job.
- Let's have a plan.

7. **In your opinion, what should the leadership of the Worcester Fire Department be doing more of?**

Answered 247
Skipped 19

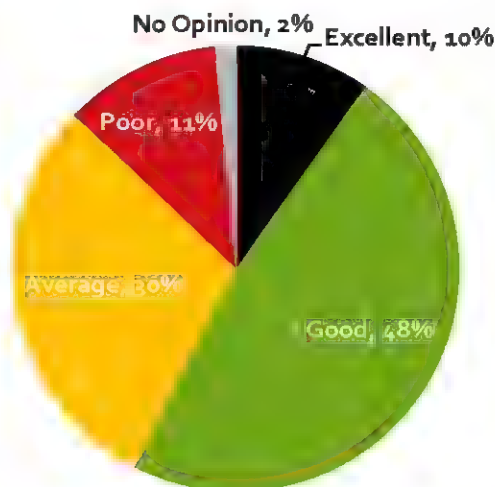
Sampling of the Most Common Responses

- Clear cut and open communication needs to be better. There also needs to be more proof that members best interests are being taken into account over what is in the best interest of the budget.
- Disciplining individuals and holding them accountable for their actions
- Following NFPA, minimum 4 per each truck, listening more closely to members not just in the administration but also in union representation.

8. **How would you rate your overall personal work environment in the Worcester Fire Department?**

Answered 264
Skipped 2

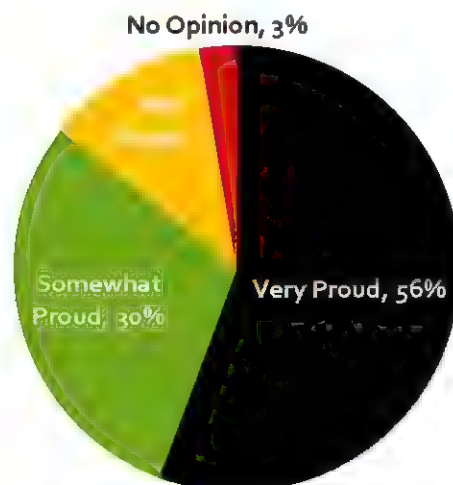
Figure 165. Question 8 Response Results



9. **How proud are you to tell other people that you are a member of the Worcester Fire Department?**

Answered 264
Skipped 2

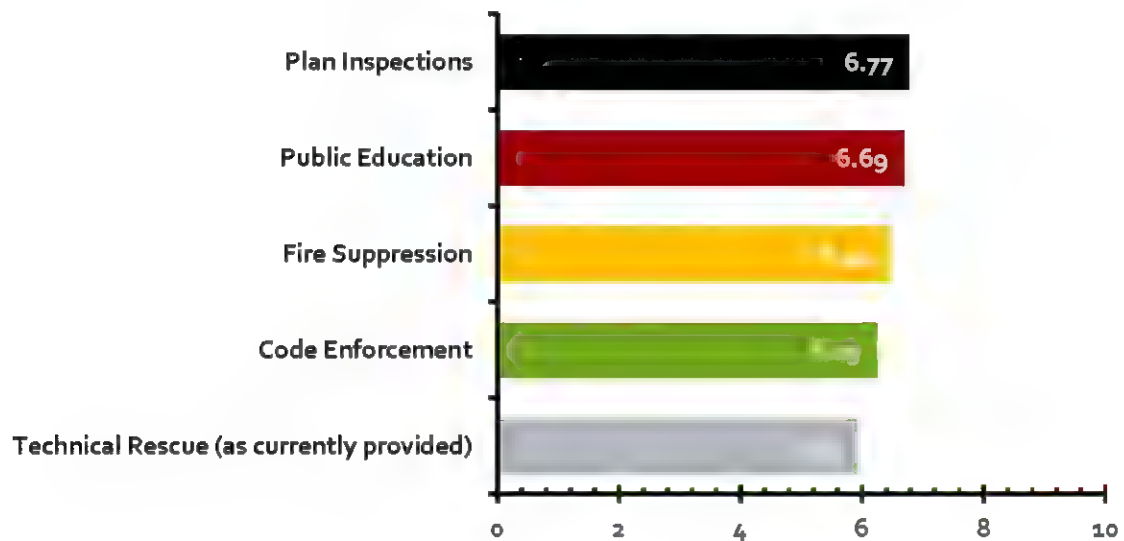
Figure 166. Question 9 Response Results



10. On a scale of 1 to 10, where 1 is poor and 10 is excellent, how would you rate the following external services and programs provided to the public by the Worcester Fire Department?

Answered 265
Skipped 1

Figure 167. Question 10 Response Results

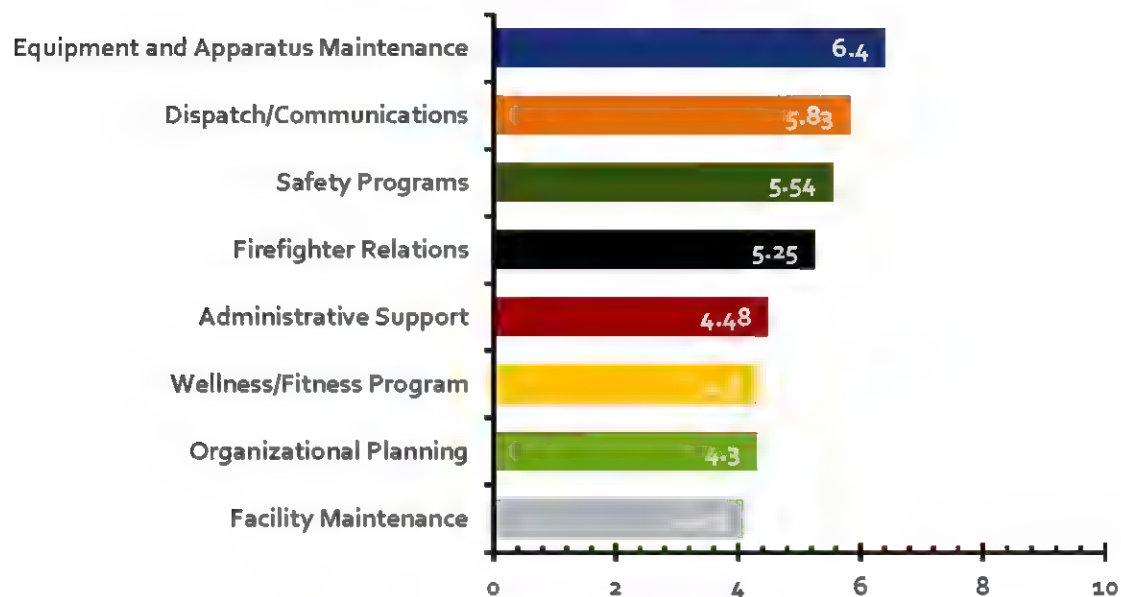


11. On a scale of 1 to 10, where 1 is poor and 10 is excellent, how would you rate the following internal services and processes provided by the Worcester Fire Department?

Answered 265

Skipped 1

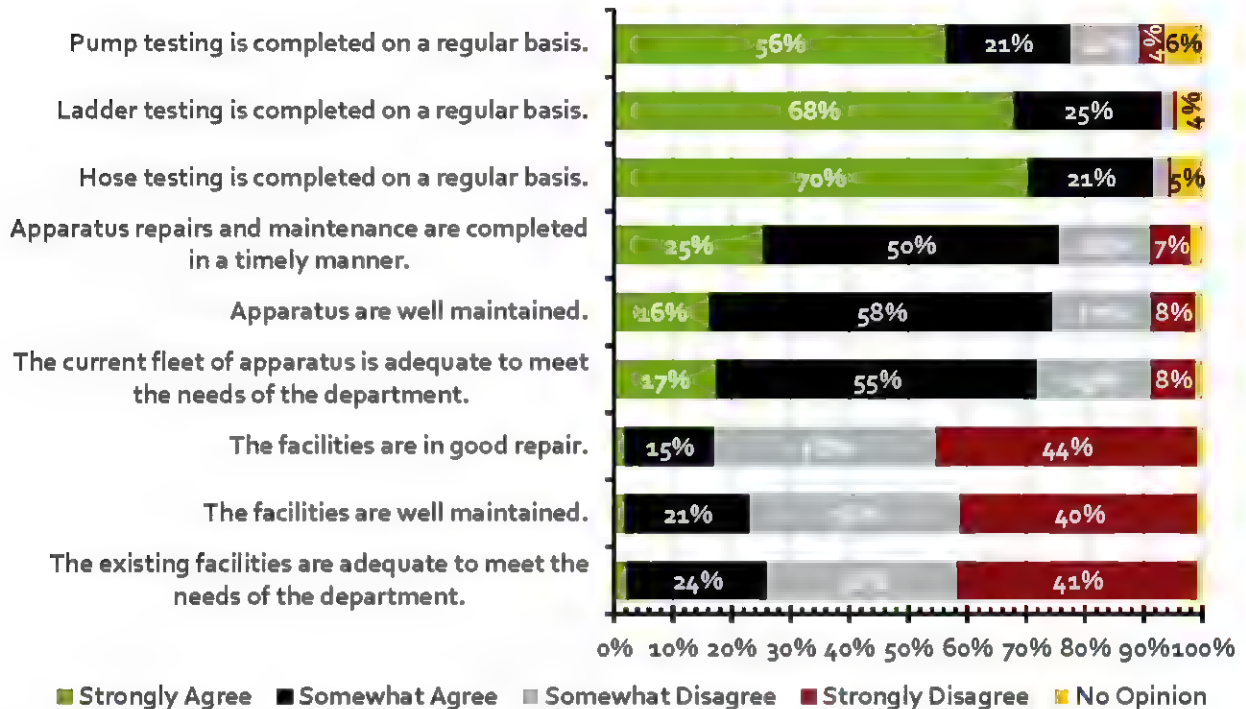
Figure 168. Question 11 Response Results



12. Please identify your level of agreement with each of the following statements about the Worcester Fire Department facilities and apparatus:

Answered 264
Skipped 2

Figure 169. Question 12 Response Results



13. If you could change only one thing about the work environment at the Worcester Fire Department, what would it be?

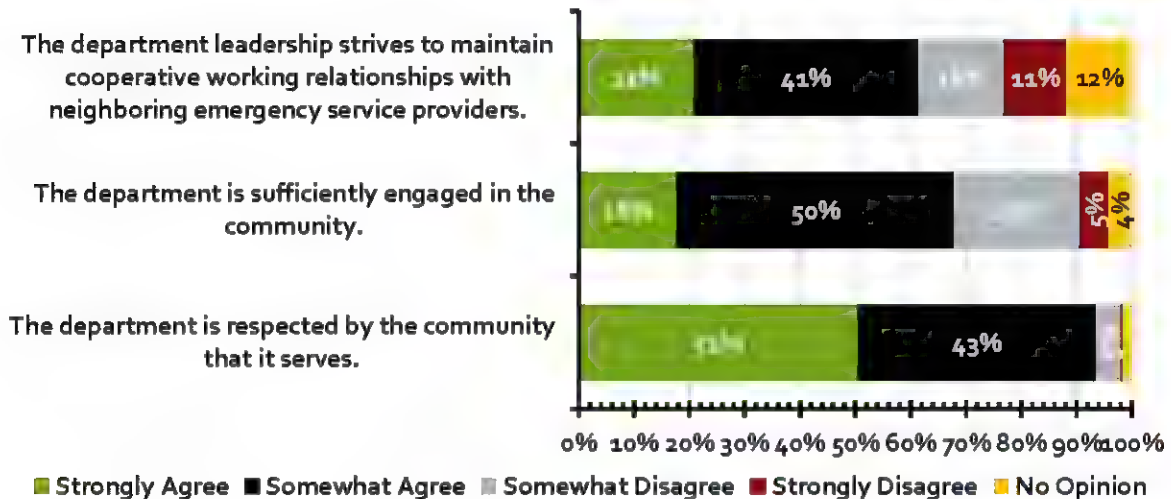
Sampling of the Most Common Responses

- 4 man minimum crew size with overtime staffed by members of same station/apparatus.
- Communication between all levels of management; create a culture centered around learning and improving.
- Holding officers accountable and not promoting those who are unfit to take on that role.

14. Please identify your level of agreement with each of the following statements as they relate to the Worcester Fire Department's community relations:

Answered 266
Skipped 0

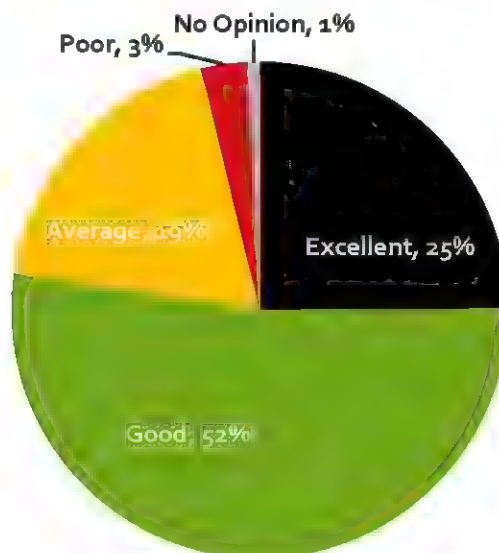
Figure 170. Question 14 Response Results



15. In your opinion, what is the community's overall image of the Worcester Fire Department?

Answered 265
Skipped 1

Figure 171. Question 15 Response Results



16. **In your opinion, what is the single greatest strength of the Worcester Fire Department?**

Sampling of the Most Common Responses

- A strong desire throughout the suppression ranks of wanting to do their job and do it to the best of their abilities.
- Commitment to the community and each other.
- Perseverance, the fact that the department and its members, despite repeated tragedies keep showing up to do their jobs.

17. **In your opinion, what is the single greatest weakness of the Worcester Fire Department?**

Sampling of the Most Common Responses

- 3 man crews.
- An almost complete lack of accountability that leads to no consequence for poor job performance, and so no improvement.
- Communication down the chain of command and communication from group to group
- Inexperience. We have a department that is so young now. Most of the veteran firefighters and old-timers are long gone and with them we have also lost generations of fireground experience and wisdom that has not been passed down to the new generation. Also, while this is a good thing, because fires are far less frequent nowadays and more scarce in between, there are less opportunities for us to learn from them and hone our craft.

18. **In your opinion, what single greatest opportunity should the Worcester Fire Department take advantage of in the future?**

Sampling of the Most Common Responses

- 3 and 1 staffing on every piece of apparatus. Staffing all apparatus adequately during weather emergencies. Activating the impact cars during weather events to cover first responders.
- Accountability. Hold everyone to the same standards. Change the promotional process to make it vet the people that are trying to get promoted.
- Community interaction/education to help reduce fire hazards in the old, inner city three deckers. Maybe sometime of reporting program coupled with a task force. For their safety and ours; more training and expanding the Training Division.

19. **In your opinion, what is the single most significant threat that the Worcester Fire Department faces in the future?**

Sampling of the Most Common Responses

- Another firefighter fatality.
- A growing population and keeping manpower at its current levels.
- A large department full of inexperienced firefighters with not enough training.

20. Please use the space below to tell us your suggestions or final thoughts for improving the Worcester Fire Department.

Sampling of the Most Common Responses

- 1. No shipping out of firefighters. Keep overtime and manpower in house so people who are familiar with the district and truck are all working together 2. only tone out the specific station that the truck is at that is being dispatched. 3. only use trucks from multi company stations to do fire watch. They always use the outlying stations for fire watch, leaving an entire district uncovered. 4. Stop sending emails to officers only. Many times the officer is out and the fill in firefighter has not received the same emails that the officer would have gotten if they were there. 5. Need to call out and make an example of mistakes. Stop being afraid to hurt someone's feelings. If someone screws up, we should all learn from the mistakes of others.
- 1.) Appropriately staff all companies in the city- three firefighters and one officer on every engine and ladder company and six firefighters and one officer on Rescue 1. 2.) Restructuring the department to place the two deputy Chiefs back in the Union. If City Hall is unwilling to place the two deputy Chiefs back in the union (IAFF Local 1009), then eliminate the administrative deputy chief positions. Create an assistant Chief's position to handle all the administrative functions. Then reinstitute the working deputy Chiefs assigned to each group to handle the operational functions of the fire department as was done prior to the year 2000 when City Hall restructured the fire department. 3.) Reorganize the promotional testing procedures to be more exhaustive than just an assessment center or a multiple choice exam. Currently lieutenants Captains and district Chiefs merely must achieve a high score on a multiple choice exam which tests one's cognitive abilities. The department needs to find a way to examine a promotional candidate's ability to make sound tactical decisions on the fireground. The fire department must also find a way to evaluate a member's longevity and work history on the fire department and make that part of the promotional process as well. 4.) the fire department needs to have its operating budget increased substantially. this increase in funds would cover staffing, more opportunities to train a younger firefighter and officer corps in structural firefighting tactics.
- A dynamic Strategic Plan to break the bonds that are holding us back. This is going to require some large daunting changes. Investment in Line Officers will make companies safer and better. These Officers will become Shift Commanders and be better Leaders and Managers. The Department needs a Chief from outside with track record of change and vision to lead the department in a new direction.

Appendix D: Table of Figures

Figure 1. Opportunities to Change the Worcester Fire Department Culture	4
Figure 2. Stakeholder Input	14
Figure 3. Stakeholder Input	15
Figure 4. Service Area Map	23
Figure 5. Worcester Fire Department Organization Chart	24
Figure 6. Risk Identification and Analysis Process ¹	25
Figure 7. Population Density	27
Figure 8. Incident Density Relative to Station Location and Population Density	28
Figure 9. Less than 75% High School or GED Attainment	30
Figure 10. Unemployment Greater than 5%	31
Figure 11. Ethnic Groups of Worcester; American Community Survey 2019	31
Figure 12. Percentage of Residents in Worcester with Health Insurance	32
Figure 13. Worcester Renter-Occupied Homes	32
Figure 14. Homeownership Less than 20%	33
Figure 15. Vulnerability Factors Matrix	34
Figure 16. Number of Households with a Disabled Person in Worcester	36
Figure 17. Income Distribution of Worcester	37
Figure 18. Earthquake Index	38
Figure 19. Temperature and Humidity in Worcester, MA	39
Figure 20. Summary of Flood Zone Risks	41
Figure 21. Flood Zones	42
Figure 22. Major Hurricanes and Tropical Storms	43
Figure 23. Saffir-Simpson Hurricane Wind Scale	44
Figure 24. Snowfall	45
Figure 25. Tornado Intensity, Enhanced Fujita Scale	46
Figure 26. Worcester Tornado Tracks, 1950–2016	47
Figure 27. Wind Speed	48
Figure 28. Major Roadways, Railroads, and Intermodal Facilities	49
Figure 29. Relative Fire and Life Risk	50
Figure 30. Zoning Classifications	51
Figure 30: Example Worcester Triple-Decker	52
Figure 32. Permitted Renovations in Triple-Decker Homes, 2018–2020	53
Figure 33. Triple-Decker Home Median Renovation Value, 2018–2020	53
Figure 34. Comparison of Fires in Triple-Decker Homes and All Other Structures, 2010–2020	54
Figure 35. Fires in Triple-Decker Homes, 2010–2020	54
Figure 36. Triple-Decker Fire Locations Since 2010	55
Figure 37. Demographics of Triple-Decker Fires Since 2010	56
Figure 38. Churches Located in the City of Worcester	58
Figure 39. K-12 Educational Occupancies	59
Figure 40. Colleges and Universities	60
Figure 41. Hospital Locations	61
Figure 42. Fire Hydrant Distribution	62
Figure 43. Overview of Factors that Influence Risk	63
Figure 44. Tier II Reporting Companies	64

Figure 45. Roads Within 2.5 Miles of a Ladder Company	65
Figure 46. Buildings Three Stories in Height	66
Figure 47. Buildings Constructed Prior to 1900	67
Figure 48. Affected Land Area.....	68
Figure 49. Frequency of Occurrence and Annual Probability of Given Natural Hazard	69
Figure 50. Impacts, Magnitude of Multiple Impacts Given Natural Hazard.....	69
Figure 51. Hazard Identification and Analysis	70
Figure 52. Community Risk Assessment Elements.....	71
Figure 53. Community Risk Reduction Planning Cycle	72
Figure 54. Community Risk Reduction Planning Considerations	73
Figure 55. Worcester Fire Department Revenues (FY 16–FY 20 Actual)	89
Figure 56. Recurring vs. Non-Recurring Revenues (FY 16–FY 20 Actual)	90
Figure 57. ESCI Grouping of Ordinary Maintenance Line Items	91
Figure 58. Worcester Fire Department Expenses (FY 16–FY 20 Actual; FY 21 Adopted)	92
Figure 59. Recurring vs. Non-Recurring Expenses (FY 16–20 Actual; FY 21 Adopted).....	93
Figure 60. Personnel Services Expense (FY 16–20 Actual; FY 21 Adopted).....	93
Figure 61. Salary/Wage Components (FY 16–20 Actual; FY 21 Adopted).....	94
Figure 62. Full-Time Fire Department Staff Count by Major Category (FY 16–21).....	95
Figure 63. Net Impact of FTE Added/Deleted on FY 20 Adjusted Personnel Services Budget.....	95
Figure 64. Ordinary Maintenance Expense by Major Category (FY 16–20 Actual; FY 21 Adopted).....	96
Figure 65. Capital Expenses by Category (FY 16–20 Actual; FY 21 Adopted)	97
Figure 66. Net Fire Department Impact on General Fund (FY 16–20 Actual; FY 21 Adopted)	98
Figure 67. Worcester Fire Department Expenditure Forecast Assumptions (FY 22–26)	99
Figure 68. Worcester Fire Department Expenditure Forecast (FY 22–FY 26).....	101
Figure 69. Projected Worcester Fire Department Status Quo Net Impact on General Fund (FY 22–26 Forecast)	
.....	102
Figure 70. Annual Salary/Estimated Benefits Various Worcester Fire Department Uniformed Positions, FY 21	104
Figure 71. Apparatus Costs (Equipped), FY 21	105
Figure 72. Actual and Projected CIP Apparatus Costs (Equipped), FY 16–21.....	106
Figure 73. Estimated FY 21 Worcester Fire Department Fire Station Construction Costs	107
Figure 74. Estimated Fire Station Operating Costs, FY 16–21	108
Figure 75. Estimated Decision Unit Staffing Costs, FY 21	109
Figure 76. Actual Average Annual Wage Increases by Select Worcester Fire Department Position, FY 16 to FY 20	
.....	110
Figure 77. Projected Decision Unit Costs, FY 21 through FY 26	111
Figure 78. Sample Mission Statement: Nashua Fire Rescue	113
Figure 79. Sample Vision Statement: City of Winchester Fire and Rescue Department	113
Figure 80. Sample Values: Chesterfield County Fire and EMS Department	114
Figure 81. Levels of Planning	119
Figure 82. Preamble to the Rules and Regulations of the Worcester Fire Department	121
Figure 83. Rules and Regulations Chapter VI, Sections 6 and 7.....	122
Figure 84. Rules and Regulations Chapter VII, Section 3	122
Figure 85. Rules and Regulations Chapter X, Section 40	123
Figure 86. Worcester Guideline Date of Approval/Revision.....	123
Figure 87. Age of Worcester Guidelines	124
Figure 88. Fire Station Condition Classifications	127

Figure 89. Worcester Fire Stations and Facilities	128
Figure 90. Worcester Fire Department Apparatus	132
Figure 91. Economic Theory of Vehicle Replacement	134
Figure 92. Criteria & Method for Determining Apparatus Replacement	136
Figure 93. Administrative Staffing	138
Figure 94. Worcester Fire Department Training Division Responsibilities	139
Figure 95. Worcester Fire Department Training Division Overtime Hours	139
Figure 96. Worcester Fire Department Training Division Overtime Dollars	140
Figure 97. The Entry-Level Firefighter Hiring Process	141
Figure 98. The Fire E's of Emergency	145
Figure 99. Fire Prevention Division Units	145
Figure 100. Fire Prevention Staffing	145
Figure 101. Fire Prevention Overtime 2019 and 2021*	146
Figure 102. Fire Prevention Division Staffing Turnover, 2015–2021	146
Figure 103. Fire Prevention Credentials Before and After Implementation of 24-Hour Shifts	147
Figure 104. Code Enforcement Unit/Inspection Functions	148
Figure 105. Code Enforcement Unit Activity, 2018–2020	149
Figure 106. Fire Investigation Unit Activity, 2018–2020	150
Figure 107. Licensing Unit Functions	151
Figure 108. License/Permit/Certificate Activity, 2018–2020	151
Figure 109. Licensing Unit Operating Schedule	152
Figure 110. Plans Review Unit Activity, 2018–2020	153
Figure 111. Maintenance Division Staffing	154
Figure 112. Worcester Fire Department Total Emergency Response Staffing	155
Figure 113. Staffing Factors	156
Figure 114. District Chief of Special Operations Responsibilities	157
Figure 115. Annual Calls for Service (2017–2019)	158
Figure 116. Service Demand by NFIRS Classification (2017–2019)	159
Figure 117: Service Demand by Incident Frequency (2017–2019)	160
Figure 118. Incident Count by 1-Acre Hexagons (2017–2019)	161
Figure 119. Service Demand by Month (2017–2019)	162
Figure 120. Service Demand by Day of Week (2017–2019)	163
Figure 121. Service Demand by Hour of Day (2017–2019)	163
Figure 122. Population Density by Census Blocks (2020)	164
Figure 123. Incident Density Analysis (2017–2019)	165
Figure 124. Worcester Zoning Classifications	166
Figure 125. NFPA 1710 4 and 8-Minute Travel	167
Figure 126. ISO 1.5-Mile Engine Company Service Area	169
Figure 127. ISO 2.5-Mile Ladder Company Service Area	170
Figure 128. ISO Fire Station 5-Mile Service Area	171
Figure 129. ISO 1,000-foot Fire Hydrant Coverage	172
Figure 130. NFPA 1710 Effective Response Force	174
Figure 131. Call Concurrency (2017–2019)	175
Figure 132. Commitment Factors as Developed by Henrico County (VA) Division of Fire, 2016	176
Figure 133. Unit Hour Utilization, 2017–2019	177
Figure 134. Total Response Time Continuum	179

Figure 135. Call Processing Time, 90th Percentile (2017–2019)	180
Figure 136. Turnout Time Performance, 90th Percentile (2017–2019).....	181
Figure 137. Travel Time, 90th Percentile (2017–2019)	182
Figure 138. Average Emergency Response Travel Time by 1 Acre Hexagons (2017–2019)	183
Figure 139. Response Time, 90th Percentile (2017–2019)	184
Figure 140. Total Response Time, 90th Percentile (2017–2019)	185
Figure 141. Mutual Aid Departments	186
Figure 142. Historical Population and Future Projections for Worcester, MA	188
Figure 143. Projected Service Demand (2020–2040).....	189
Figure 144. Fire Growth vs. Reflex Time	192
Figure 145. Fire Extension in Residential Structures, United States, 2011–2015	192
Figure 146. Cardiac Arrest Event Sequence	193
Figure 147. Six-Step Compliance Model	211
Figure 148. Table 6.7 Minimum Inspection Frequency	214
Figure 149. Baseline Performance Analysis	218
Figure 150. Optimized Locations of 10 Fire Stations	219
Figure 151. Baseline Performance with Station 2 Removed	220
Figure 152. Optimized Location for 10 th Fire Station.....	221
Figure 153. Question 1 Response Results	223
Figure 154. Question 2 Response Results	224
Figure 155. Question 3 Response Results.....	225
Figure 156. Question 4 Response Results	226
Figure 157. Question 5 Response Results.....	227
Figure 158. Question 1 Response Results.....	229
Figure 159. Question 2 Response Results	230
Figure 160. Question 4 Response Results	231
Figure 161. Question 5 Response Results.....	232
Figure 162. Question 1 Response Results.....	234
Figure 163. Question 2 Response Results.....	235
Figure 164. Question 5 Response Results	236
Figure 165. Question 8 Response Results	238
Figure 166. Question 9 Response Results	238
Figure 167. Question 10 Response Results	239
Figure 168. Question 11 Response Results.....	240
Figure 169. Question 12 Response Results.....	241
Figure 170. Question 14 Response Results	242
Figure 171. Question 15 Response Results	242